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Contents.

	PAGE
Forthcoming Events	33
A Review of the Foundry Industry	33
The British Steel Foundry Industry in 1933	35
The British Malleable Foundry Industry in 1933	36
Foundry Development	37
The Foundry Equipment Industry in 1933	38
Alloy Cast Iron and High Duty Cast Iron in 1933	39
Refractories in 1933	40
The Aluminium Foundry Industry	41
The Work of the Institute of British Foundrymen in 1933	43
Trade Conditions in 1933 in the Grey-Iron Foundry Industry	45
The Italian Foundry Industry in 1933	46
The French Foundry Industry	46
Railway Foundry Mechanisation	47
Foundry Research in 1933	49
Mechanisation of Foundries	51
The Light Castings Industry in 1933	52
The Non-Ferrous Foundry in 1933	53
The American Foundry Industry in 1933	54
Czecho-Slovakian Foundry Industry in 1933	55
The German Foundry Industry in 1933	56
The Non-Ferrous Metals in 1933	57
The Foundry Industry Month by Month	58
The Austrian Foundry Trade	59
The Foundry Pig-Iron Industry in 1933	62
The Nickel Industry in 1933	64
This Week's News in Brief	66
Raw Material Markets	68

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN, THE NATIONAL IRONFOUNDING EMPLOYERS' FEDERATION, THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION.

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Forthcoming Events.

Institute of British Foundrymen.

JANUARY 26.

Middlesbrough Branch:—Evening visit to a local works. (Details later.)

JANUARY 27.

Birmingham, Coventry and West Midlands Branch:—Annual dinner.
Wales and Monmouth Branch:—Meeting at The Merchant Venturers' Technical College, Bristol, at 6.30 p.m. Lecture by G. E. France. (Illustrated by cinematograph film.)
Scottish Branch (Edinburgh Section):—Meeting in the Heriot Watt College, Edinburgh, at 4 p.m. "Problems in Woodworking Machinery Castings," Paper by R. Ballantine.
East Midlands Branch:—Meeting at Loughborough College at 6 p.m. "Some Non-Ferrous Foundry Problems," Paper by F. Dunleavy.
Lancashire Branch (Junior Section):—Meeting at Manchester at 7 p.m. Lecture by H. E. Beardshaw.

FEBRUARY 3.

Lancashire Branch:—Annual whist drive, dinner and dance, at Grand Hotel, Manchester.
Scottish Branch (Falkirk Section):—Meeting at Falkirk Technical School at 6 p.m. "Metallography of Iron," Paper by N. A. W. Erskine.

FEBRUARY 7.

Lancashire Branch (Preston Section):—Meeting at 7.30 p.m. "Refractories and their Application," Paper by J. Masters.

A Review of the Foundry Industry.

Obviously the foundry industry is affected by political considerations, and if we were asked which were the six most important factors of world-wide importance in 1933 we should enumerate the following: (1) The disintegration of the League of Nations; (2) the rise of Hitlerism; (3) the American experiment at reorganisation; (4) the Irish relationships with the British Empire; (5) the Japanese policy, and (6) the general improvement in trade. We do not intend to correlate all these happenings, but they are all of immediate or future fundamental importance. Last year saw the full working of the tariffs, and but few would say that they had not been of real assistance to the domestic market, not only in reducing imports of material which we can very well make ourselves, but also in eliminating what was quite often an unfair type of competition. One can take steel castings as a typical instance of where the value of imported castings has dropped from £327,917 in 1929 to £8,860 last year. Another important factor is that a few foreign firms have decided to create foundries in this country or have their castings made in existing establishments. Thus new foundries have started up at Birmingham and Bedford, whilst works at Gateshead and Sheffield are making castings previously imported. A pleasing feature of 1933 was the manner in which British foundry-equipment firms successfully undertook the work previously left to foreign experts.

The Steel-Castings Industry.

At the beginning of April the Steel Castings Association introduced a new price list. Immediately this was in force one fairly large foundry dissented, mainly on a question of quota allocation, and price chaos continued, with a resultant orgy in price cutting. However, as the market was stiffening and a 20 per cent. gain in production was being realised, there was a definite improvement in every direction. If the excess capacity still existing within the industry is to be utilised to the full, an effort will have to be made to popularise the use of steel castings, and, with this thought in mind, one cannot but regret the make-up of the 1st Steel Castings Report. Lack of co-operative effort is allowing inroads of an unwarrantable character to be made by weldings and iron castings. It is pleasing to learn from Germany that the competition from weldings is subsiding, and it only needs intelligent propaganda domestically to make British engineers hesitate before embarking on material possessing little background of reliability over prolonged service. There has been a distinct improvement of the order of 20 per cent. in the total export value of steel castings compared with 1932. For this year it seems likely that the economic position of the steel-castings industry will have to be reviewed in the light of its general association with the iron-founding and steel industries.

Non-Ferrous Activities.

The control instituted in the production of various metals forming the raw material of the non-ferrous foundry industry has probably helped rather than hindered the consumer. This control has every appearance of being continued during the current year. Trade has undoubtedly been better, especially amongst the light-alloy founders, and to-day we hear of firms asking to be excused from quoting. This is because the automobile industry has made such material progress both in the home and export markets. Consequent upon the Budget legislation many non-ferrous founders have had to pay an increased price for their fuel-oil. The importance of this varies inversely with trade improvement, as melting costs assume a major importance when the raw-materials markets is weak and falling. In the technical field many important developments have been made, especially in the direction of producing a more elastic material. Once again we would express the indebtedness of the foundry industry to the British Non-Ferrous Metals Research Association for the quiet, unassuming way in which they render such signal service, mainly by co-operation with the Technical Committee of the Institute of British Foundrymen.

Malleable Ironfoundries.

The malleable-ironfoundry industry has continued the enterprise it has shown in recent years, but with a slight orientation. After placing many orders for pulverised-fuel-fired rotary furnaces, a good start has been made with furnaces similar, but oil-fired. Now rumour is busy that a new installation has just placed an order for still the same type of furnace, but gas-fired. Whether this is producer or town's gas, we know not. Last year saw the new foundry at Bedford get into production, and this year extensions are planned for Leys at Derby. Changes are being made in annealing practice, and at last a continuous in contradistinction to a batch-annealing plant has been

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installed. Short-cycle annealing has been developed, but, generally speaking, the buyers prefer material which has undergone the standard heat-treatment. Trade has steadily improved, despite the fact that there has been a lessening in demand for electrical castings owing to the completion of the grid scheme. This loss, however, has been made good by the increased demands of the automobile industry.

Ironfounding in General.

One of the outstanding events of last year was the greatly increased activity of the National Ironfounding Employers' Federation. Steps have been taken to strengthen its organisation, and if certain of its activities mature, as they have every prospect of so doing, it will be in a splendid position to be of material assistance to the whole industry. Mr. Smith, of South Shields, its President, deserves unstinted praise for the energy and enthusiasm he has put into the Federation activities. Another equally important phase was the co-ordination which has been achieved in the light castings trade under the ægis of the British Ironfounders' Association, which is dealt with later.

Mechanisation is progressing slowly but surely, and the list included in Mr. Brackenbury's article is somewhat impressive. During 1933 new continuous-casting plants were installed by Sinclair, Stanton, Sterling & Midland Electric Manufacturing Company, and a number is envisaged for this year. For instance, Qualcast are to extend, but whether or not this extension will embrace continuous casting one knows in advance that no factor will be neglected which will contribute to the economic quantity production of castings of high-grade quality. There is a good market for this class of casting, and such firms as Harper's of Willenhall, Russell's of Leicester, and Revo of Tipton have been kept reasonably busy throughout the year, and the prospects for this year are distinctly promising.

The big jobbing foundries are picking up rapidly, and certain ones, such as Glenfield & Kennedy, are well booked up, but the smaller ones are not nearly so well placed, and some of them are not so busy as they were six months ago.

Alloy cast irons are becoming a serious factor in engineering, and the propaganda which has been made in a quiet unostentatious fashion is bearing fruit. In this connection the Bureau of Information on Nickel has been of outstanding help to the industry. A new entrant in the field of special cast iron is the Meehanite process, which has been put into operation in London and Stockton-on-Tees. Its progress will be watched with a good deal of interest by the ironfounding industry.

Light Castings.

The endeavours which have been made during the last few years to effect a measure of co-operation within the industry have at last borne fruit, and to-day about 98 per cent. of the firms within the light-castings industry participate in aiding the general welfare of the industry, whilst 60 per cent. of the production is sold at scheduled prices. No one person is responsible for this, but much credit is due to Mr. W. R. Blair, the director of the British Ironfounders' Association. A good internal organisation materially helps business in the international market, and it is pleasing to record that an arrangement for the sale of baths has been arranged on this basis. Business has also been helped materially by the Government's slum clearance and housing policies. Because the consumer is now paying an economic price for builders' castings, certain of the daily papers have given space to attacks by misguided individuals, who refuse to correlate the overall price of a dwelling and the cost of the few pounds-worth of castings they incorporate.

The industry has hung on to the export market "by the skin of its teeth." It has increased its tonnage from 10,522 tons in 1932 to 12,968 last year, but a further decrease in the average price is registered. In 1931 it was £44, in 1932 £42, whilst last year it was only £41 10s. It is obvious that there is need for further international co-operation if the market is to be worth while entering for any founder of no matter what nationality. The progressive decline from 17,852 tons in 1930 to 10,500 in 1932 has been arrested, but he would be a brave man to say that it was a profitable undertaking.

The gas-stove section of this branch of the industry has been particularly well employed, as an effort has been made to replace the thousands of inefficient apparatus which have done duty for often 20 years or more throughout the country. This campaign will continue until every domestic user has a stove which does credit to modern foundry practice. The important radiator foundries are still turning out enormous tonnages despite the handicaps they encounter in their export business.

Pipe Founding.

Now that the municipalities are beginning to end their retrenchment schemes, prospects for the pipe foundries are distinctly brighter. Centrifugal casting can be considered a form of mechanisation, and this type of plant has been extended during the year, whilst Stanton has put into commission a continuous-casting plant for bends and connections of various sorts. The adaptability of such plant is shown by the fact that during the later months of last year the plant was engaged upon the production of cast-iron road plates for the Mersey tunnel. As a demand for cement- or concrete-lined pipes has arisen, the Clay Cross Company has installed a special plant for this purpose. The export market has shown a gain of about 24 per cent., but the average selling price is much lower at £9 12s., compared with 1932 when it was over £12. Whilst exports have thus increased from 65,539 tons in 1932 to 86,327 for last year, imports have been reduced from 3,241 tons to 1,413 tons, or more than halved. In 1931 they were as high as 13,000 tons. Whilst in 1932 they averaged £17 a ton, last year the figure reached over £21.

The Automobile Foundries.

This section of the industry has enjoyed a marked degree of prosperity. The home demand has been satisfactory, whilst exports have been of a record character. The Ford foundries have now effected the removal from Cork to Dagenham, and have increased their activities to embrace malleable-iron production. The Austin foundries have registered much better progress with their mechanised foundry in recent months. There is an unconfirmed rumour that one of the largest automobile foundries intends completely to reorganise its already highly-mechanised foundry during this year.

The unattached foundries are still suffering from price cutting, and it is to be regretted that individualism is still so strong that the handful of specialist firms are unable to form some sort of co-operative association to maintain an economic level.

Other Foundries.

Without exception every class of foundry has felt some benefit from the general improved trading conditions, but those catering for ship-building and cotton textiles have had the least benefit, the former owing to the general shrinkage in the volume of trade done on the international market, and the latter to Japanese competition in India and elsewhere. The railway foundries have been distinctly busier, and in this issue Mr. Turbett, of the Southern Railway, describes the first continuous-casting plant ever installed in a British railway shop. The roll foundries and those making ingot moulds and castings for the large iron and steel works have been well employed so far as the domestic market is concerned. The agricultural-implement foundries have not yet recovered their pre-war importance, except those catering for dairy machinery and small power plants. The machine-tool foundries have not had so much Russian business as in 1932, but in common with the general heavy engineering foundries there has been a distinct improvement. The specialised foundries, such as those catering for the sugar, printing, sewing-machine, wool-textiles and chemical industries have closed the year with their order books in a much healthier condition than was the case a year ago.

Technical Developments.

The outstanding event of the year was undoubtedly the Prague convention. This was not on account of the Papers read nor yet attributable to the intrinsic interest in the works visited, but rather the lessons which were to be derived from the intelligent manner in which the Czechs correlate science with quality. This is also done in British foundries, as almost every issue of THE FOUNDRY TRADE JOURNAL reveals, but from a slightly different angle. Here the technicians are controlling metal mixtures, sands, processes and costs, but in certain of the Czech foundries it is moulding as a craft which is being controlled.

The technique of inoculating cast iron is making serious strides, and tensile strengths thought to be impossible five years ago have now been reduced to the level of routine work. The Cast Iron Research Association has made a notable contribution to this development.

Whilst the Institute of British Foundrymen, through its technical committee, has now produced two reports, one on sand and one on malleable, we attribute much more importance to the efforts it has made to consolidate, co-ordinate and to expand its activities. Under the leadership of Mr. J. W. Gardom no section is allowed to slacken its endeavours—a herculean task when one considers the voluntary character of its membership. The experiment is but two or three years old, and it is now no exaggeration to say that the Technical Committee is one of the most important factors in British engineering and metallurgical industries. Its recommendations, coming as they do from the leaders of thought within the foundry industry, are such that no body of scientists, technicians or industrialists can possibly afford to ignore them. But this unique position will only be maintained so long as the present virility and enthusiasm remains. Fortunately, the conduct of affairs is in excellent hands.

Conclusion.

We little thought last year, when in thanking the Employers' Federations for the confidence they accorded us we sympathised with their difficulties and suggested, as a way out, the creation of an over-riding association co-ordinating all phases of activity, that 1934 would see this desirable end well within the bounds of practical realisation. There is, however, still much more work to be done, and though there are numbers of founders who remain individualists in an age of co-operation, they too are appreciative of the efforts, often arduous and disappointing efforts, made by a handful of enthusiasts working for the ultimate good of the industry in general. The more one knows of the inner working of the whole of the British foundry industry, the greater is one's admiration for the enormous amount of self sacrifice made by its more enlightened owners, managers, technicians, foremen and operatives, who are striving to improve its economic, technical and social level. This year we would like all these people to devote some of their energy and money towards completing the educational structure of the industry in support of Professor Andrew's scheme for the creation of a degree course in foundry practice within the metallurgical department of Sheffield University.

The British Steel Foundry Industry in 1933.

By SIR ROBERT HADFIELD, Bart., D.Sc., F.R.S. (Chairman, Hadfields, Limited).

THE preparation of this article is a much more pleasant task than it was for those who dealt with the same subject for the last three years; not so much on account of what has been accomplished, but because of the promise which 1933 gave of improved prospects for this year.

Following the long and drastic post-war depression, it seems to be generally the opinion that during the last few months business conditions in many industries showed a very definite improvement, in some directions more marked and rapid than in others, but none the less sufficiently pronounced to have brought about a distinct feeling of optimism that the corner has now been turned.

Some justification for this optimism is indicated by an examination of the world's steel production. This attained a maximum in 1929, when 119,000,000 tons were reached. In 1932, production only reached 42,000,000 tons, which means that consumers were drawing on stock, as this figure does not balance the amount of steel lost by corrosion. I estimate that last year about 70,000,000 tons of steel were made.

Whether or not this optimism is justified remains to be proved. Certainly it prevails in the steel-castings industry, but, although increased activity is in some measure being experienced, it is necessary to be extremely cautious in pronouncing it a definite indication of a return to permanent recovery. To do so at this stage would be both unwise and misleading, because, as suppliers to other industries, the markets of which in many cases lie abroad and are inextricably linked up with world economic conditions, prosperity in the steel-castings industry must necessarily depend upon, and can only follow, an improvement in these other directions, and in some of these the improved conditions have yet to manifest themselves to any marked extent.

Mining, shipbuilding and the hydraulic and sugar machinery builders, which normally absorb an appreciable proportion of the production of the steel-casting firms, may be considered instances of this nature. In these directions the demand is very curtailed and limited, but some encouragement may be gained from the fact that some of the railway companies are now entering on new programmes of construction, which are very welcome indeed, and should add appreciably to the activities of the steel foundries of the country.

An important feature bearing on the situation has been the granting by H.M. Government in 1932 of a 33 per cent. import duty, established for three years, on all steel castings entering the country. In this connection the following figures representing the imports of rough steel castings into Great Britain and Northern Ireland during six months of 1931, as compared with the corresponding period of 1933, are illuminating:—

	1931.		1933.	
	Tons.	Value. £	Tons.	Value. £
April ..	518	10,647	22	360
May ..	587	11,237	56	985
June ..	294	6,337	81	1,324
July ..	511	11,032	55	668
Aug. ..	552	12,452	51	909
Sept. ..	432	7,676	24	560

Although it cannot be claimed that the reduction of imports in the later period is entirely due to the influence of the protective duty, it can certainly be said it has had a marked effect in conserving the home market to the British producer.

It is interesting to note that whereas in 1931 the average value per ton was £20 10s., by last summer it had fallen to £16 12s.—a figure more usually associated with grey-iron than steel castings. Table I shows the United Kingdom production, imports and exports of steel castings for years 1929 to 1933.

Associated with the passing of the Import

SIR ROBERT HADFIELD, BART., D.Sc., F.R.S.

Duties Act was the condition that the iron and steel trade should prepare schemes for reorganisation, a stipulation which has called for much careful study and consideration of the situation in all its aspects and in all the various branches of the industry. Conferences have been held, and many discussions have taken place; these are still continuing, and though, owing to the complicated and difficult nature of the problems involved, no degree of finality has yet been reached, from information just published it appears that a certain amount of progress towards that end has now been made.

Although this outlines the position so far as the general question of reorganisation is concerned, much has been done by individual firms to put their "houses in order" and enable them to cope with modern demands. In the Sheffield district, in particular, the evolution and production of special steels has developed with noticeable and commendable rapidity. The Hadfield "Era" manganese steel, which has proved itself the most efficient material for resisting the wearing action met with in crusher jaws, dredger parts, railway and tramway points and crossings, is being applied for these and similar purposes, with ever-increasing popularity; whilst the heat-resisting and non-corroding steels are meeting a long-felt want in engineering and industrial applications which call for steels having the unique properties they possess.

TABLE I.—*U.K. Production, Imports and Exports of Steel Castings for years* 1929–1933.

	Production. Tons.	Imports.		Exports.	
		Tons.	Value. £	Tons.	Value. £
1929 ..	166,900	14,156	327,917	1,504	58,934
1930 ..	177,300	12,414	298,528	2,093	83,043
1931 ..	128,700	6,481	130,805	1,093	39,388
1932 ..	115,000	1,631	31,487	724	32,095
1933 ..	127,700	498	8,860	1,032	40,256

The most regrettable feature of the year was inability of the foundries to adhere to the revised price list which was put in force in April. As no real stocks of steel castings exist

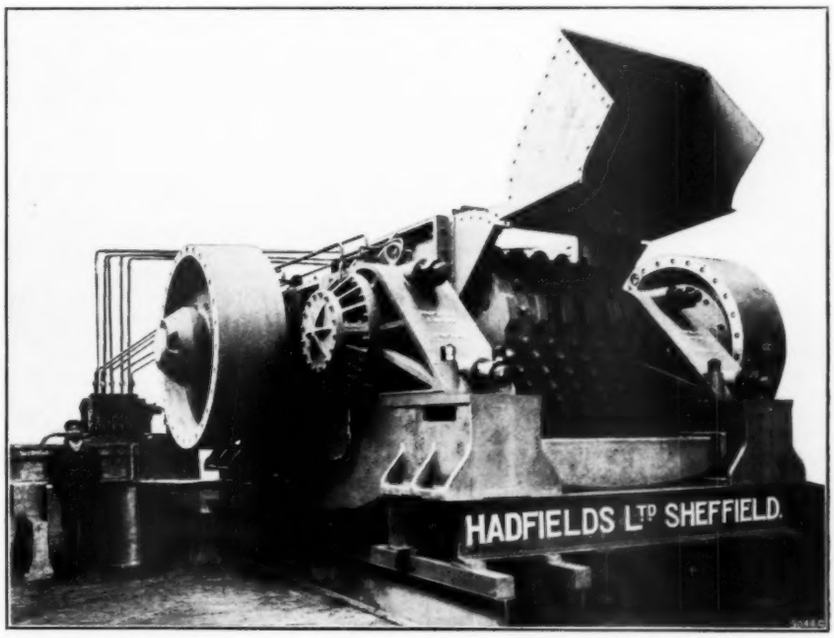


FIG. 1.—THIS HIGH-SPEED IRON ORE CRUSHER IS CAPABLE OF REDUCING 3-FT. PIECES OF ORE TO 8-IN. PIECES AT THE RATE OF 500 TONS AN HOUR. IT WEIGHS 30 TONS AND HAS BEEN DELIVERED TO THE CORBY PLANT OF STEWARTS AND LLOYDS.

an excellent opportunity was afforded and indeed is still available for this section to assure at least economic prices for the products of its industry. What has been accomplished so successfully in the light-iron castings industry, by co-operation and goodwill, is surely worth emulation by steel founders.

The First Steel Castings Report.

My views* on this Report were printed in the FOUNDRY TRADE JOURNAL. They showed very clearly that the highest class of casting, proved to have withstood the most drastic tests, had been made by my company's foundries. My criticisms were made with the object of dispelling somewhat the gloomy impression induced by a study of this report. It was pleasing to read confirmation of these views later in the year when Capt. Shane of the American Admiralty expressed himself in extremely eulogistic terms of the quality of steel castings made in Great Britain. Capt. Shane was in an excellent position to appraise the situation as he spent several months in European foundries. Nevertheless, the Report was worth while inasmuch as it showed that there was still much work to be done in correlating data and making them more readily available for the solution of future problems.

I am both cognisant and appreciative of the work which also is being done by the Steel Castings Sub-Committee of the Institute of British Foundrymen, the honorary membership of which association I value most highly.

Technical Competition.

With the development of the art and science of welding a new form of competition has to be met by both steel and ironfounders. Welded structures which are built up from standard rolled-steel sections joined together by deposited metal or tiny castings, require no pattern and where but one component is required, can be made more cheaply. Their success has been due in no small measure to the close co-operation between designers and welding experts, a co-operation well worth emulation within the foundry industry. Before final judgment can be passed as to their real worth the time factor must be allowed to impose its full effect, for it is yet too early to postulate to what extent welds will be affected by fatigue stresses and corrosion.

The iron foundry, too, is making progress in regard to castings of special nature. Alloyed grey-iron castings are now available showing tensile strengths reaching and exceeding 25 tons per sq. in. The boundary between iron and steel castings is gradually narrowing, but in my opinion engineers should be prepared to go a step further in the correlation of ultimate performance with initial price, the result being that they would find that the purchase of steel castings would be true economy.

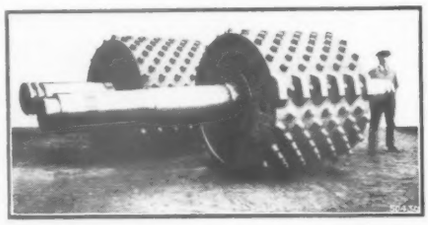


FIG. 2.—THE ROLLS INCORPORATED IN THE PLANT SHOWN IN FIG. 1 ARE 72 IN. DIA. AND 60 IN. WIDE. THEY WEIGH 30 TONS EACH AND ARE MADE FROM HADFIELD HARDURA STEEL CASTINGS.

Recent Progress.

The illustrations, Figs. 1 and 2, show two views of a crusher which my company has recently built for the Corby plant of Messrs. Stewarts and Lloyds. This is a typical example of a machine imposing a maximum demand on the resources of both metallurgist and moulder.

Outstanding Events of the Year.

It was perhaps a little unfortunate that the International Foundry Congress held in Czecho-Slovakia and the visit of the Iron and Steel Institute to Sheffield were both held simultaneously early in September, as both afforded inspection of some of the largest and most modern steelfoundries in Europe. In both cases the visitors were deeply appreciative of the efforts made for their reception and of the wonderful progress registered by the foundry industry in recent years. Because of my sincere appreciation of the art of the foundryman, and a desire to maintain for Sheffield and Great Britain the prominent position it has always held in the field of metallurgical tuition and research, I decided that the visit of the Iron and Steel Institute was an opportune time to help forward in a practical manner the general desire evinced by the foundry industry to inaugurate a Degree Course in Foundry Metallurgy at the local University. Prof. Andrew, who presides over the Department of Metallurgy at Sheffield with such eminent success, has, in conjunction with his Advisory Committee, been working hard to inaugurate the scheme, and I appeal to my fellow foundry owners to provide the necessary capital to ensure that the British foundry industry has not merely equal, but superior technical facilities to those existing abroad.

An event of last year, which gave much pleasure to me personally, was the presence of the Lord Mayor of Sheffield (Alderman F. Marshall) at the 31st annual dinner of my company's ambulance society, because Alderman Marshall was continuously employed in the shops of Messrs. Hadfields, Limited, as an ordinary workman for 30 years. In his speech he recalled that some years ago, during my negotiations with the Trade Unions, I suggested a week's holiday with pay for the workmen. The narrowing of the gap between conditions of employment as applied to the clerical and operative staff has long been, and still is, one of my ambitions directed towards general social advancement.

* FOUNDRY TRADE JOURNAL, vol. 48, page 411.

The British Malleable Foundry Industry in 1933.

By Col. C. A. LINDOP (Managing Director, W. Lindop & Sons).

General Remarks.

IT is an acknowledged fact that for many years the malleable-iron industry in this country has not had anything like its share of trade, in proportion to that which it enjoys in other countries.

Supplies up to a few years ago were not nearly so consistent in quality as they should have been, with the result that engineers generally looked upon malleable as rather an unknown quantity, and were inclined to leave it out of specifications when it could be replaced by another product; in fact, broadly speaking, the trade has passed through a long period of inertia, it has lacked publicity, and manufacturers have been inclined to sit on the fence and hope for better times rather than take the more arduous road of research in an endeavour to improve its position and expand its field of activity. Happily, this period has passed; malleable iron is coming into its own, and we may well look back on 1933 as the beginning of a new era. Great strides have recently been made in the improvement of control, both during the melting and annealing processes, and the malleable iron of to-day is a reliable product giving high-tensile and elongation results and capable of being machined at a very high speed. The growing popularity of the rotary furnace for its production is one of many proofs that manufacturers are no longer content to jog along in the same way as in the past. Engineers, more and more, demand strength and lightness of castings to go hand in hand, and the malleable industry is meeting this demand by its ability to supply thin section and intricate design. As it becomes more widely known that a malleable casting is a reliable product, produced under scientific control and capable of withstanding the most severe tests, so will its popularity increase and its markets grow.

Malleable Castings for the Motor and Heavy Vehicle Industry.

Motor-car and lorry manufacturers have for some time past taken a fair proportion of malleable castings; the amount has varied somewhat of recent years owing to the severe competition of forgings and stampings, but, generally speaking, malleable iron has held its own, and recently the tendency has been to use more malleable; this is particularly noticeable on the heavier type of vehicle. During the last twelve months the motor industry has been the one bright spot in a general depression through which most trades have gone. Increased production has, of course, increased the demand for supplies, and the main difficulty has been in endeavouring to meet this demand at very short notice owing to manufacturers working from hand to mouth and holding as little stock as possible.

General Engineering.

The demand for castings for general engineering has been poor, and has shown little or no improvement over the last few years. Shipbuilding and agricultural engineers, ordinarily large consumers of malleable castings, have been particularly quiet, although there are now definite signs of improvement in these trades. With the completion of the national grid system, the demand for malleable for electrical engineering has definitely slowed down; on the other hand, the increased activities of the principal railway companies should give a fillip to trade in other directions.

Of the future it is difficult to forecast, but if malleable firms will work more together in a spirit of co-operation, and prove to designers that their product is an economical necessity to engineering generally, the future should definitely be one of increased trade and prosperity.

The annual meeting to renew the Continental Ferro-Silicon Syndicate will shortly be held at Vienna, when it is expected that the syndicate will be extended for another year. No radical changes in organisation or important decisions are likely to be made, as competition is now non-existent following the agreements with British independent producers and the French makers made a few years ago. Ferro-silicon sales in the second half of 1933 advanced appreciably with the improvement in steel production, prices remaining unchanged. The German branch of the syndicate, which embraces seven producers, will probably also be extended for a further year.

Foundry Development.

By Professor J. H. ANDREW, D.Sc. (Sheffield University).

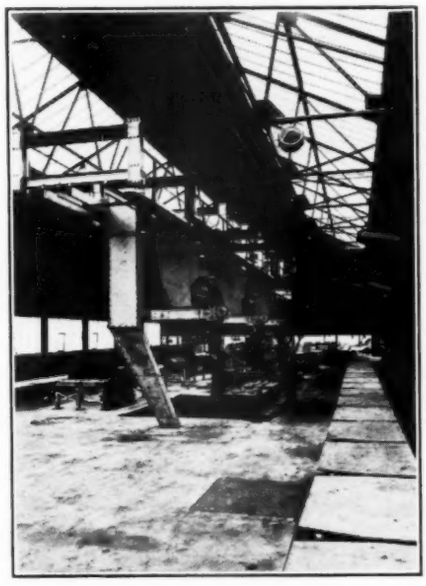
IT is by no means an easy task to depict in any definite manner the advances that have been made in foundry technique and science within recent years, and in writing on this subject one can only deal with generalities, treating the subject on a broad basis and throwing out a few hints with respect to possible future developments.

From the engineering standpoint, foundries continue to develop in a remarkable manner; mechanisation is being introduced more and more each year, and as this is closely concerned with repetition work in which each process is carried out in exactly the same manner on each occasion, it can only assist in foundry development on correct lines. Even so, however, whereas the productive unit may be working according to plan, it does not necessarily mean that the procedure adopted is correct. For instance, whereas moulding, core-making machines and foundry appliances generally may be working in an entirely satisfactory manner, the quality of production rests largely with the man in control of the sand mixtures, which introduces the question of sand research, and also research work in general.

On the question of material, particularly with respect to new types of cast iron, progress continues, and such material as nitrided iron, austenitic iron and special alloy irons continue to find more extended uses. In a material such as cast iron there are only certain factors which can be varied at will; the difference between iron and steel is largely a matter of carbon content, and in cast iron much depends upon the form in which that carbon exists. It is well known, for instance, that if in a cast iron the carbon is in the combined state, the iron will essentially be hard. The modern tendency, however, would seem to be the production of an iron, the metallic characteristics of which possess certain well-defined properties, containing carbon in the form of graphite of a particular nature. In other words, it is largely a matter of the configuration taken up by the graphite particles on which properties and uses of these special irons depend. It is possible, for instance, to have the graphite in the form of coarse flakes, in the form of temper carbon, or to have it existing as very thin, well distributed, and short curly flakes. All these forms are possible in the same composition, and each one may be obtained by varying the method of casting, and it would seem that the use to which alloy metals might be put would be that by their addition under normal conditions of casting the desired configuration of the graphite would result, without having to resort to any particular method of casting or after heat-treatment. Further, dependent upon the uses to which the material was put, there would also be the particular form of graphite desirable, and it would seem to be a useful avenue for investigation to carry out experiments on alloy irons with special reference to the graphite particles, rather than concentrate too much attention upon the effect on the metallic matrix, the properties of which may to a large extent be derived from a study of equilibrium diagrams and alloy steels.

A Missing Link.

In reading Papers dealing with investigations on cast iron, it is only rarely that one finds introduced a thermal freezing and heating curve. Although steel metallurgists invariably take a thermal curve of every new steel which is made, the same cannot be said of those concerned with the production of alloy cast irons, judging from published results. It is, however, just as necessary to determine the freezing and melting points of all new materials, whatever they may be, and, moreover, one should not be content to take only one time-temperature curve, but these should be repeated at least two or three times in order to see whether the same results are obtained after each melt, for it is well known that melting temperature can have an important effect upon the resultant constitution of the final product. It is only natural that new alloy steels continue to be produced at a more rapid rate than alloy cast irons, largely due to the fact that with respect to steels the investigator has at his service a considerably greater amount of scientific data than is at present available for those who concentrate their attention on cast irons. There would appear to be more justification for extended work on alloy irons in which carbon is absent, for, whereas it would be almost too much to hope to obtain material of greater strength than at present inherent in the carbon alloys, as carbon is almost bound to associate itself with a certain amount of gamma iron at high temperatures, with the resultant transformation into alpha iron and pearlite at a lower



A MECHANISED FOUNDRY FOR PIPE BENDS INSTALLED BY STANTON EARLY IN 1933.

temperature. There are many elements, which when added to iron will entirely prevent any change from taking place from the melting temperature to a temperature below that of the atmosphere, and there would seem to be many uses for alloy irons in which no critical change was present, particularly if a combination of elements was so arranged that the iron was largely strengthened without the addition of carbon.

Diffusion and Grain Growth.

It must be born in mind, however, that materials which are homogeneous in nature and undergo no transformations at any temperatures cannot be refined (except by working either hot or cold) with respect to the crystalline structure. There is one saving factor, however, which allows certain refinement to be made in solid solutions. This is due to the original cast structure rarely being homogeneous; it is usually cored, and on annealing the act of diffusion will in some cases serve to break down the grain size. It may certainly be said that so long as diffusion is taking place grain growth will not occur, so provided the casting can be cooled rapidly to promote a small grain size, casting stresses may be removed by a short-time annealing without giving rise to objectionable grain growth.

The importance of the process of centrifugal casting should be mentioned. This method, besides being applied to the casting of pipes, is now employed for other articles. This process has been adopted to an appreciable extent in non-ferrous practice, and many firms are making extraordinarily good castings by this means. Centrifuging in itself is almost bound to give rise to a more homogeneous material, provided that the metal is not spun in the liquid state for sufficient time to allow of any separation of the constituent phases. The question as to whether a separation could possibly be brought about by the centrifuging of a liquid solution is extremely doubtful, but, even so, all possibility of this taking place is avoided by the metal becoming solid soon after the spinning action has begun.

Non-Ferrous Foundry Practice.

Non-ferrous foundry practice is developing at an extraordinarily rapid rate and definitely on scientific lines; so much so, that it is difficult to keep apace with the new inventions and discoveries which come into the market yearly. Light alloys particularly have improved almost beyond recognition, when compared with those available only a few years ago, whilst the process of age-hardening, which not long ago was but of scientific interest, is now being utilised in giving increased strength to many cast alloys.

All new discoveries and inventions are bound to create a difficulty, which is in the selection of the best material for any particular purpose, and as the choice of material is becoming very much greater, in the future it will be almost necessary to determine every possible physical characteristic of the different alloys, so as to allow one to make finer degrees of subdivision. The choice of irons for resisting abrasion, and of iron, steel and non-ferrous metals for resisting corrosion becomes wider and wider, and it is only by a system of direct and scientific comparison that the best alloy for any particular purpose can be determined. The numerous alloys on the market necessitate that those who are to guide in their selection should be *au fait* with most of them, which involves a considerable amount of study and a wide knowledge.

Synthetic sands and synthetic refractory materials are rapidly coming into the market, for it is now realised that whereas natural products may possess certain virtues, it is the correct mixing of these that will give rise to the desired material. Indeed, it may be said that synthetic methods will be utilised in future for the making up of moulding sands, core sands and refractory materials to the same extent that metallic alloys are synthetically composed. Research work is responsible for these innovations, and it is only by giving concentrated attention to simple mixtures—shall we say binary mixtures—followed by a careful examination of the effect of a third and, perhaps, a fourth ingredient, that the best sand or refractory will eventually be established.

Correlation of Constants and Properties.

Unfortunately, refractories, when mixed together, often behave in a manner entirely unsuspected, and until the more complex systems have been thoroughly investigated, it is quite impossible to determine the effect produced by mixing together several ingredients merely by a study of the physical properties of each ingredient separately. This also applies to metals, and,

whereas one may find a similarity of characteristics associated with certain elements, such as, for instance, a periodic variation of the physical properties with the atomic number, as yet no expression has been arrived at to correlate one physical property with another. This in itself seems strange, and it may be only a matter of time before some constant will be derived which will serve for the calculation of any and all the constants based on one particular factor. It should be the aim of all investigators to find out the relation between various properties and one or two easily determinable constants. Such a discovery is bound to result some time, and its derivation will depend upon the intuition of a genius.

In view of the fact that laboratories attached to the various industrial firms are bound to concern themselves largely with work of an industrial character, one must look to the Universities and other scientific institutions for the derivation of scientific data, and further, when such data is obtained, it would be of great advantage if its application to practical work could be pointed out, and, if possible, experiments should then be made on a large scale to prove or disprove the contentions made in any published result. It is for this reason that a University laboratory equipped with small-scale foundry plant would be of great value to the industry, for it is realised that mass plays an important part in physical and chemical reactions, and it is only by having at one's service methods for utilising and experimenting with larger masses than are common to most experimental research laboratories, that data of direct value to industry can accrue. Just as data, if it is to be exact, must be obtained by the use of accurate scientific instruments, experimental work should be carried out to a stage further and so brought into line with practical working.

For experimental work on cast iron the laboratory equipment necessary is considerably greater than that which suffices for steel research. Furnaces of reasonable capacity, facilities for moulding, core making and for the making of actual castings are necessary just as is the complete physical equipment for testing sand and the metal units. It is suggested that the former absence of such experimental plant is responsible for a certain lack in the scientific development of the cast-iron industry, but now that this omission has been remedied possibilities arise that did not previously exist.

The Foundry Equipment Industry in 1933.

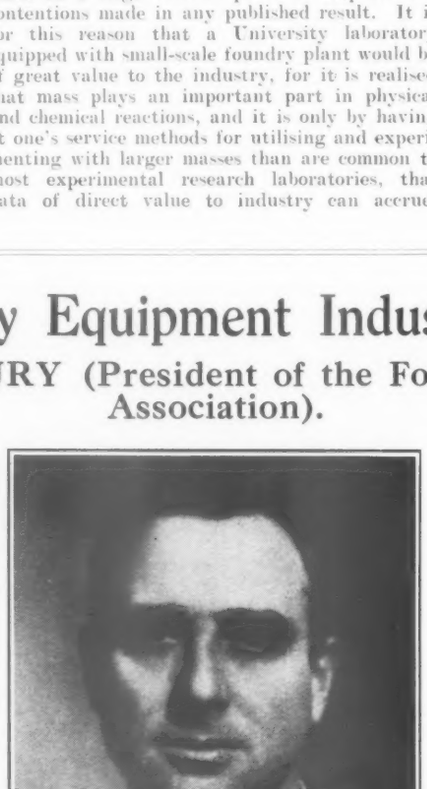
By R. H. BRACKENBURY (President of the Foundry Equipment Supply Association).

THIS past year has seen something of a metamorphosis in the foundry-equipment business. The activities of most of the well-known Continental firms have been curtailed and, to some extent, replaced by newly-formed British companies and by the extended activities of well-established ones. Moreover, it is recognised that the conveyor manufacturers now constitute a very important section of the foundry-equipment industry. How true this is will be realised from Table I, which lists some of the more important mechanised foundries in Great Britain.

TABLE I.—*Partial List of British Mechanised Foundries.*

Firm.	Location.	Production.
Ferranti	Lancashire.	Electrical fittings.
National Radiator	Hull.	Radiators.
Crane's	Ipswich.	Radiators, malleable fittings.
Morris	Coventry.	Automobile castings.
Ford	Dagenham.	Do. do.
Austin	Longbridge.	Do. do.
Davis	Luton.	Gas stoves.
Midland Electric Manufacturing Co.	Birmingham.	Switch and fuse gear.
Stanton	Holwell.	Pipe bends and specials.
Cardiff Foundry Co.	Cardiff.	Manhole covers.
Sinclair	Wellington.	Builders' castings.
Sterling Metals ..	Coventry.	Automobile castings.
Midland Motor Cylinder Co.	Smethwick.	Do. do.
Sterling Manufacturing Company	London.	Mangles.
Crabtree	Walsall.	Electrical castings
English Steel Co.. .	Sheffield.	Steel castings.
Southern Railway..	Eastleigh.	Railway castings.
Suffolk Iron Foundry	Stowmarket.	Repetition castings.
John Harper & Sons (Fettling shop)	Willenhall.	Do. do.
Guest, Keen & Nettlefolds	Cwmbran.	Railway castings.

It is not to be understood that the above list is complete, for no definition of a mechanised foundry can, or does, exist, and partial mechanisation is in evidence at Qualcast of Derby, Newman Hender of Stroud, Russell's of Leicester, Leys of Derby, Peters of Slough, Alfred Herbert of Coventry, Singer's of Clydebank, Daimler of Coventry, the English Electric Company of Rugby, Stubbs of Manchester, and Glenfield & Kennedy of Kilmarnock. In many of these cases, mechanisation has only extended to the provision of sand-handling plant or the making and handling of moulds in a section of their shops.



MR. R. H. BRACKENBURY.

Furnaces.

There was a new entrant to the foundry-equipment business last year, who came into the field with a new type of rotary oil-fired furnace which has found application in three malleable and two high-duty grey-iron foundries. The pulverised-fuel-fired rotary furnaces have continued to make progress and new installations have been sold to both malleable and grey-iron foundries. The crucible furnace has not merely held its ground but tends to extend its field into the domain of the iron foundry for the melting of alloyed-iron castings. The cupola, too, in spite of inroads made by the newer forms of melting plant, has confirmed its economic potentialities, especially since the introduction of the balanced-blast and similar systems and several important installations have been built. On the export side of the business very little has been done, but this year should show an improvement as several important metallurgical plants are projected for the Dominions and the less industrialised foreign countries.

For the non-ferrous foundry industry there was shown at the British Industries Fair the most comprehensive exhibit of oil-fired melting plant ever staged.

Sand-Preparing Plant.

This section of the foundry-equipment trade has had a good year, as it is becoming more and more recognised that clean, cool sand of standard grain, size and moisture content is prerequisite of good foundry practice. The prospects, too, for this section are still good as the field is a particularly wide one.

Stoves and Ovens.

Good progress has been registered in this section also, and the firms supplying vertical continuous core-drying stoves have been exceptionally well employed. These plants have been installed at Morris, Austin, Qualcast, Ford's and several other shops. Batch stoves, too, are becoming more and more efficient every year.

New Installations.

Several new foundries have been put into commission last year, the most important of which is the malleable foundry at Bedford. Ford's have installed a malleable plant, and for this year another of the Radiation plants is to be fully mechanised, whilst two new foundries are to be opened up in the Birmingham area. The bath foundry at Greenford has doubled its capacity and now is capable of turning out about 2,000 baths per week.

Foundry Exhibition.

In the spring of last year an Exhibition of Foundry Equipment was held at the Agricultural Hall. Though the number of exhibitors was small, the quality of the exhibits was exceptionally high, and those firms which had the courage to take space were rewarded as, undoubtedly, excellent business was recorded. The Foundry Trades Equipment and Supplies Association was deeply appreciative of the enthusiastic help given to exhibition authorities by the Technical Committee of the Institute of British Foundrymen, the British Cast Iron and the Non-Ferrous Metal Research Associations in connection with remarkable stands they organised showing the technical advances recently registered by the industry.

As President, it is indeed a pleasure to acknowledge the many courtesies which are invariably extended by the technical institute to the Foundry Equipment Association, and this society would welcome anw *rapprochement* made with the object of closer co-operation on the technical side. It should be more widely recognised by Dominion and Colonial founders that the Equipment Association is particularly well placed to help them when visiting Great Britain to obtain a maximum benefit from their stay.

Alloy Cast Iron and High Duty Cast Iron in 1933.

By J. E. HURST (Vice-President of the Institute of British Foundrymen).

THE view might be taken that the year 1933 has been characterised by the consolidation of numerous developments already made in the field of alloy and high-duty cast irons rather than the introduction of further new developments. The Foundry Trades Exhibition and the Shipping, Machinery and Engineering Exhibition have been held during the year, and in both these exhibitions it is true to say that the most prominent feature was that of special cast irons. In the former, the Technical Committees of the Institute of British Foundrymen co-operated with the British Non-Ferrous Metals Research Association in the display of typical examples and other data illustrating the progress in foundry practice and products over recent years. This display served an additional purpose in demonstrating the vigorous nature of the Institute of British Foundrymen and through its Technical Committees the great potential value it is capable of exerting for the benefit of the industry. The British Cast Iron Research Association at both exhibitions was able to stage a comprehensive exhibit in which the progress made in alloy cast irons and high-duty cast irons, due in no small measure to its own efforts, was given full prominence. These comprehensive exhibits were reinforced by those of private firms, who, in displaying their own products, still further emphasised the rapid strides which have been made over the last few years in this section of ironfoundry metallurgy.

The phrase "high-duty cast iron" is used frequently nowadays, but it possibly possesses different meanings in the minds of different people. The author prefers to use the phrase to cover all those cast irons, alloyed or otherwise, in which, by virtue of control and modification of the composition and manufacturing methods, the various properties, either singly or conjointly, are raised to a higher standard than those of the ordinary common grades of cast iron. It is probable that the most important high-duty requirements in cast iron are brought about by the use of alloy additions, although it has become increasingly realised that the control of the total carbon and phosphorus contents, in addition to the silicon contents, can be utilised to bring about substantial improvements, particularly in the strength properties. In this connection it is of interest to refer to the important research work undertaken by Mr. W. West, of the Farington Steel Works of Leyland Motors, Limited. This work has already demonstrated the important influence of the phosphorus constituent on the soundness and freedom from porosity of castings, particularly those of complex design and sections. As this work proceeds there is no doubt that it will play a very important part in elucidating the principles which govern the production of sound castings.

Thirty-Ton Tensile Grey-Iron Castings.

In the field of high-strength cast iron, probably the most important development is that of the use of nickel additions. This method, which is covered by the British Patent Nos. 290,267 and 352,510, has been referred to at some length in the publication B.15 recently issued by the Bureau of Information on Nickel. By this process castings can be made possessing tensile strengths up to 30 tons per sq. in. in the "as-cast" condition, and even these high strength values can be raised still further by suitable heat-treatment by hardening and tempering, and by this method ultimate strengths of upwards of 35 tons per sq. in. have been realised. Such strength values have not been associated previously with commercial cast irons and surely mark a tremendous forward step in the progress of cast iron. In brief, these results are obtained by the addition of nickel and silicon to molten cast iron of a composition which would normally cast white. By bringing about the graphitisation in this manner, a metal is obtained which gives grey castings of remarkable strength and uniformity in widely-varying sections. A diagram showing the possible ranges of strengths obtainable in cast irons of this class in relation to the silicon and nickel contents is included in Fig. 1 (page 40).

Cast Irons for Heavy-Duty Wear.

The field of hard cast iron for heavy-duty wear resisting and abrasion-resisting conditions has been widened considerably by the introduction of

MR. J. E. HURST.

new types of cast-iron alloys. Not long ago chilled cast irons were all that the ironfounder had to offer. Now this field is reinforced by cast irons which can be hardened and tempered, both by oil-hardening and air-hardening processes; by hard martensitic irons; and by irons capable of being surface hardened by the nitrogen-hardening process. Numerous applications of these various types of hardened cast irons have been developed during the year. Alloy cast irons of the plain chromium type and nickel-chromium type are being used for the manufacture of hardened and tempered cylinder liners, piston rings and valve seats and other uses for such materials are developing steadily in the textile-engineering and general-engineering industries. The martensitic cast-iron alloys are finding similar applications, and the nitrogen-hardened cast iron, which is, of course, an aluminium-chromium alloy cast iron, is now used extensively for cylinder liners and a wide variety of castings used in general-engineering work, such as cam castings, edge-tool dies, hardened-jig parts and similar tool-room work. This nitrogen-hardened cast iron is capable of developing a surface hardness of over 1,000 Firth diamond-hardness numeral, a hardness which is greater than that of quartz and somewhat less than that of a sapphire. There is an extremely important feature in both Nitricast-iron and the martensitic cast irons in that the hardness values are accompanied by a graphitic structure. As in ordinary grey irons, graphite is still present in these hard irons in the usual forms, and this is a feature of undoubted value in numerous applications of hard cast irons to abrasion and wear-resisting conditions. In this respect they differ from the chilled white irons, which are usually almost completely free from graphite in the chilled wearing surfaces. Even in the class of chilled-iron castings, considerable improvements have been brought about by the use of alloy additions. The use of chromium and nickel-chromium additions are being increasingly resorted to with the object of providing materials of still greater intrinsic hardness and greater strength. This improvement in the strength properties is likely to be of great importance in extending the field of application of white cast irons.

The influence of phosphorus on the properties of hardened and tempered chromium alloy cast irons has been investigated and the results presented in the form of a Paper by the writer before the May Meeting of the Iron and Steel Institute. In a further Paper before the September Meeting of the same Institute the author presented the results of a comparative investigation into the wear-resisting properties of Nitricastiron.

Molybdenum.

The use of this metal as an alloy addition to chilled castings, particularly chilled rolls, has attracted considerable attention. The use of this metal has increased enormously in the steel industry; whilst the greater tonnage is used in wrought steels, its beneficial effects have not been lost sight of in steel castings. Ironfoundrymen during the past year have given the employment of molybdenum their serious attention. On the scientific side, the British Cast Iron Research Association and others have gone into the question of the effect of molybdenum additions to cast iron, and much useful work has been accomplished in the study of the precise effect of the alloy metal.

The addition of small percentages of molybdenum does undoubtedly lead to increased tensile strength; whilst this property is of value in certain directions, the future use of molybdenum would seem to be not in this field, but rather its action in, for example, reducing the effect of mass; in other words, giving more uniformity of properties through a given section, so enabling weight reduction to be made. The reduced tendency to growth and deterioration of structure at temperatures above atmospheric, and also increased impact strength at elevated temperatures, are secured by molybdenum additions. The air-hardening properties of molybdenum are also utilised in the heat-treated cast irons, so reducing the risk of distortion which arises when quenching in a liquid medium, as well as simplifying heat-treatment.

Before concluding these brief remarks on the development of molybdenum, mention should be made of the importance of correctly alloying the metal, or, indeed, any expensive alloy which is used by the iron foundry. It need hardly be said that it is essential to employ a high-grade base iron if the full effect of alloying additions are to be brought out. A source of frequent trouble is in the method of introducing the alloy; this is frequently added to the ladle or at the spout of the cupola. Whilst careful control will yield good results, there is always the risk of non-uniformity in the castings, resulting in hard spots. To avoid this danger molybdenum-containing pig-irons have been developed during the past year; these are of good base irons and contain from 1.00 per cent. of molybdenum upwards. It is only necessary for the foundryman

to add the required percentage of pig-iron to his charge necessary to produce the desired molybdenum content in the casting, so ensuring that the molybdenum will be uniformly and completely dissolved in the castings.

Austenitic Cast Irons.

It is true to say that steady development has taken place throughout the year in the application of the various austenitic cast irons. These are familiar under the names of No-Mag, Ni-Resist, Nicrosilal and Hypocrode, and all contain substantial quantities of nickel. No-Mag contains nickel and manganese, and in this respect bears some resemblance to the Resista steel made by Sir Robert Hadfield in 1896 and containing about 5 per cent. manganese and 14 per cent. nickel, and which was non-magnetic. Typical compositions of Ni-Resist and Nicrosilal are as follow:—

	Ni-resist.	Nicrosilal.
Total carbon	2.8— 3.1	1.75
Silicon	1.3— 1.7	5.0— 6.0
Manganese	0.75—1.25	Up to 1.0
Nickel	12.5—14.5	18.0
Chromium	2.5— 5.0	—
Copper	5.0— 7.0	1.5— 5.0

The general properties of the austenitic cast irons are quite distinctive. They are non-magnetic or feebly magnetic and possess a high electrical resistivity. They are of medium strength, low Brinell hardness and generally possess a low elastic limit with considerable deformability. They are somewhat susceptible to work-hardening and can be temper-hardened or are susceptible to precipitation hardening. They do not harden on quenching and possess a high coefficient of expansion and a low thermal conductivity. They find a use in the electrical industry for non-magnetic castings and castings for resistances. They are also of great value under many conditions where erosion resistance is called for and have a value quite equal to some of the non-ferrous metals under many corrosion-resisting conditions. They show a marked superiority over ordinary cast iron for scale-resisting purposes at high temperatures. Nicrosilal (British Patent No. 378,508) was developed by the British Cast Iron Research Association for heat-resisting purposes and has already found numerous applications for these purposes. Their high coefficient of expansion is of great value in many applications where a cast-iron material is required to work in conjunction with non-ferrous alloys, particularly the aluminium alloys, and in a like manner their ductility renders them suitable for many applications where malleable castings have been used hitherto. In many respects the close resemblance of the properties between austenitic cast irons and the bronzes has led to the study of the commercial application of the former to the production of decorative and ornamental castings. There are those who believe that the public taste in colour of decorative metal work is gradually changing away from the yellow metals in the direction of the more steely colours. If this be the case, it is possible that through these newly-discovered austenitic cast irons the ironfoundry may regain the important position it used to possess in the supply of decorative metal fittings. This aspect was fully dealt with and illustrated by examples in a recent Paper by the author before the Newcastle branch of the Institute of British Foundrymen. A very important aspect of the austenitic cast irons is their welding properties. This has been drawn attention to by Mr. J. G. Pearce (*vide* Institute of Welding Engineers, January, 1933). Tests have shown that both the austenitic cast irons Nicrosilal and Ni-Resist possess excellent welding properties, both for welding the same metal and for use as a welding rod for ordinary cast iron.

Alloy Pig-Irons.

It is impossible to review the developments in alloy and high-duty cast irons without referring to the corresponding developments in the production of alloy pig-irons. Such pig-irons are now available to various specifications and containing either singly or conjointly such elements as chromium, nickel, copper, vanadium, titanium, molybdenum. The use of such pig-irons rich in alloy content is unquestionably the most reliable method of making alloy additions to cast-iron mixtures in the foundry.

Commercial Aspects.

Whilst it is difficult to estimate the commercial importance which has been achieved by alloyed cast iron, the list of licensees for the manufacture of Silal and Nicrosilal is already impressive. The quantity of nickel sold to the foundry industry has been increasing every year since the formation of the Bureau of Information on Nickel Limited, some five or six years ago. Unlike alloy steels, the manufacture of which is largely situated in Sheffield, this business is gravitating to no particular centre and most districts are now contributing their quota. Probably the automobile industry is the largest user of alloyed cast iron, but its employment is appreciated by the chemical, shipbuilding, electrical engineering and railway industries. Finally, a word of warning is necessary. No foundry should undertake the manufacture of these special irons, unless it is prepared to institute a proper metallurgical control over its melting plant and processes.

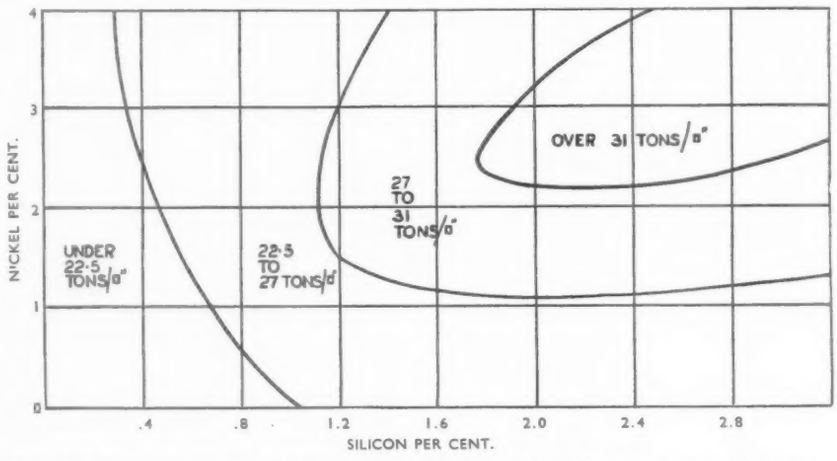


FIG. 1.—DIAGRAM SHOWING STRENGTHS OBTAINABLE IN HIGH-STRENGTH CAST IRON WITH VARIOUS PROPORTIONS OF NICKEL AND SILICON.

Refractories in 1933.

By T. ALLEN (Managing Director, Gibbons Brothers, Limited).

THE year 1932 was one in which a return of confidence was most noticeable; substantial progress followed in 1933, and as this happily applies to the basic industries, it naturally follows that the refractory industry has correspondingly benefited. It has been a year in which, at any rate, many people have seen some recovery in their fortunes, but from an economic point of view the refractory industry cannot be said to have received its due reward. Fortunately, it is thought the day of buying in the cheapest market is passing, but it has been a long and trying business to educate the user; even now, in many instances the price factor unfortunately predominates.

Technically, the refractory industry is better equipped to-day than it has ever been; the research carried out by several important bodies, the result of which is available to anyone interested, coupled with the practical tests made by various manufacturers at their own works, enables us to recommend materials which will give a reasonably good life. There has been a great improvement in the design of furnaces for the various trades, which calls for special types of refractories, and, whilst there are, of course, many problems still to solve, we can congratulate ourselves that the knowledge we now have enables us to supply material that has a reasonable chance of success in use. This brings home the point mentioned above as to the paramount importance of the intelligence of the user; all the care and thought in design of plant, no matter for what purpose, coupled with the best refractory material available in this country, can be ruined by negligent operation. From his visits abroad, the author has noticed with what extreme care new plant is put into operation, which has an enormous effect on the life and efficiency of the structure, and he emphasises this as it is his personal opinion that in some trades the user has not kept up with the pace of the designer and manufacturer. It is not the purpose of this short article to detail specific cases, but it is pleasing to be able to postulate the conviction that the improvement in the refractory industry is such that, given a fair price for its products, there is nothing to fear from the point of supplying goods of the best class compared with any other country, always, of course, having regard to the raw materials available.

The industry has to acknowledge its indebtedness to the present Government for its trade policy, which has been no mean factor in encouraging manufacturers to put their very best into the developments indicated above, and it can look forward to 1934 with renewed confidence in the manufacturers' capacity to overcome any further difficulties.

The Aluminium Foundry Industry.

By I. D. TAVERNOR, B.E., A.M.Inst.C.E. (The British Aluminium Company, Limited).

THE year 1933 has seen an increase in the total production of aluminium castings as compared with the previous twelve months, which is a good omen for the future of the foundries. This increase in output has not been accompanied by any rise in price levels, in fact, the reverse has happened, and the year will be remembered by all those directly concerned with the industry as one of intense competition and low prices. It has been a "buyers'" year.

Although there have been no startling discoveries, it can be said that the production of alloys has continued steadily with most encouraging results, and some of the improvements have undoubtedly established light alloys more firmly in certain industries. For instance, the silicon alloys have always been popular on account of their excellent qualities, both in the foundry and under service conditions. They combine fluidity, good resistance to corrosion, and fair strength with toughness, but they have been handicapped to some extent by the fact that their yield point is on the low side. After much research it has been found possible to overcome this disadvantage by the addition of definite proportions of magnesium and manganese. The resultant alloy is susceptible to heat-treatmept, which improves the yield point by 50 per cent. without adversely affecting the other properties already mentioned. The value of such an improvement lies in the fact that a further weight saving can be obtained by reducing the area of stressed members, without any reduction in the factor of safety.

Low-Expansion Alloy.

Another type which has received a good deal of attention is known as the low-expansion alloy and is used for the production of pistons. The engine designer has always asked for the difference in coefficient of thermal expansion of the materials used for cylinder walls and pistons to be as small as possible, and the recent introduction of compositions containing higher percentages of silicon, together with other alloying elements has brought this about to some extent. It has not, however, made the task of producing sound castings any easier. Opinion is still divided, moreover, because the mechanical properties of "Y" alloy, R.R. 53, and others at elevated temperatures, appear to be better. This is generally the deciding factor, since the tendency in engine design is to go for high power-weight ratios with increased compression and temperature. The consumer is, therefore, rather loth to change from well-tried materials at the moment when the conditions of service become more severe.

High-Tensile Alloys.

Interesting developments have taken place in the magnesium alloys of aluminium in the cast form. The wrought alloys of this series are already well known as MG. 7, RR. 66 and Birmabright, but recently castings with high mechanical properties have been produced. These alloys contain about 10 per cent. of magnesium and after heat-treatment are reported to have an ultimate tensile figure of 24 to 26 tons per sq. in. Their casting, however, presents peculiar problems and the technique is somewhat similar to that used with the magnesium alloys containing aluminium. Once such tensile figures can be consistently obtained without excessive increase in the production costs, there should be a large field of application. It is interesting to note that in the recent light-weight rolling-stock constructed in America these new alloys have displaced steel for many of the bogie members,

MR. I. D. TAVERNOR, B.E., A.M.INST.C.E.

and their behaviour in service is being watched by a large number of engineering interests.

The three series already described are perhaps the outstanding examples of alloy development, but in each case a certain amount of extra expense is involved for heat-treatment or special technique. On the other hand, as anyone acquainted with the number of patents filed each year will appreciate, there have been a number of alloys brought forward which do not involve any increase in the expense of production. Some of these claim to produce superior finishes, others better machining qualities, but usually higher mechanical properties are the aim of their producers. One alloy at least, known as "Aeral," claims to show improvement in all three. The popularity of white metal for decorative purposes has also been instrumental in the development of "special" alloys. It is common knowledge that silicon, and to a less extent magnesium alloys, have a bluish tinge when polished, just as the alloys with nickel are much whiter. Recently alloys containing chromium and cadmium have been put forward as possessing particular advantages for architectural work when used in the same way.

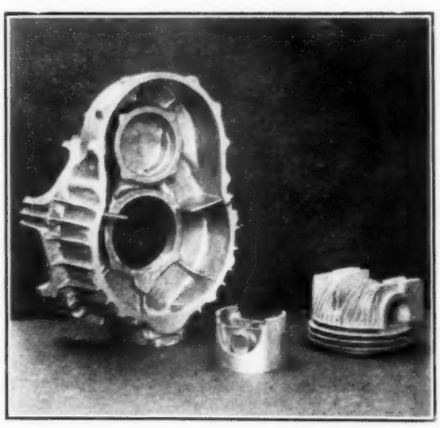


FIG. 1.—CASTINGS IN HIDUMINIUM "R" ALLOYS, INCLUDING SAND-CAST CRANK-CASE, HIGH DUTY ALLOYS, LIMITED.

Despite the increase in the number of alloys used in the foundry, the alloys already established do not suffer as might be expected; it seems that the newer compositions are only used for specialised purposes. Silicon, copper and zinc are still the main alloying elements and the only criticism which can justifiably be made is that there are, as there have been for years past, too many alloys in general use. A reduction in number would simplify the task of both the foundryman and the producer and the requirements of the consumer would still be fulfilled.

Foundry Equipment.

Within the foundry itself there have been few developments in equipment. Melting under vacuum is still largely experimental, and the resultant melt requires special attention on account of increased shrinkage. The electric furnace, while admittedly superior as regards the quality of melt produced, is still uneconomic compared with other types. If the price of electricity could be reduced sufficiently for the electric furnace to be competitive in price, the foundry industry would benefit to a very large extent.

The remainder of the equipment has been improved in two directions, firstly the growing adoption of electrical energy for heat-treatment furnaces, secondly the re-introduction of non-metallic pots in place of cast iron. The former is the result of a general demand for closer temperature control, but the latter is due to improvements in the manufacture of the pots, which now have a sufficient length of service to compete with the more common iron type.

By degrees the problem of controlling the gas content of aluminium castings is being solved and credit for this must be given to the experimental and research programmes undertaken at the British Non-Ferrous Metals Research Association's laboratories. It seems that, whereas the old practice was to mix the flux well into the melt, it may now be sufficient to remove the oxide film which tends to hold the hydrogen in the metal.

Anodic Treatment.

The field of application for aluminium was increased by the introduction of the anodic finishes for protective and decorative purposes, the most generally used process being the Bengough-Stewart, which has a solution of chromic acid for the electrolyte. This process, however, was not completely successful when applied to castings unless they were almost perfect, and it has been shown that other acids, particularly oxalic and sulphuric, are less troublesome media for the treatment of commercial grades. The films obtained can be very hard, and this has resulted in some forms of anodising being tried on pistons. The matter is still under consideration, but the concensus of opinion at present is that while the piston-ring grooves have a much greater resistance to wear, the cylinder bore itself is considerably affected where the piston walls are anodised

Anodic oxidation is generally adopted for conditions where the extra expense can be justified, but there are a number of cases where an inferior film would be sufficiently resistant and where the extra first cost of anodising cannot be justified. Where this is the case, a film formed by chemical means is preferable. The

best-known of such processes is the Modified-Bauer-Vogel, or M.B.V., which has been recently introduced to this country. No licence is required, the apparatus is inexpensive, and the results good provided that correct chemicals of the highest purity are used.

A third form of surface-treatment which is being extensively tested consists of spraying a coat of iron or similar metal on to the aluminium. There appear to be great possibilities in this for surfaces in sliding contact if the process can be made commercial; up to the present the work has been largely experimental, but the early results are said to be encouraging.

Fig. 2.—A Group of Aluminium-Alloy Castings by Dennis Brothers.

Demand Improving.

The demand for aluminium castings has shown a steady improvement in the last six months of 1933, and with improving trade conditions this is likely to continue; even so it will be a long time before consumption can come anywhere near the production capacity of the foundries. New applications will bring about a more rapid improvement, and in many cases such applications have already been tried and proven in other countries, so that in suggesting their adoption there need be no fear of failures. An outstanding example is the use of aluminium-silicon alloy castings for exterior metal work on buildings and statuary. In one set of buildings alone in New York there are nearly two thousand tons of such castings—in the whole of this country the total can hardly exceed two hundred. Again, any traveller in the latest Continental rolling-stock will notice the frequency with which aluminium fittings are used. They are attractive in appearance, not easily damaged and the total weight saving to the railway is considerable. Modern metal furniture has become popular, generally with a white metal finish; the corresponding article in aluminium is lighter and stronger, and there is no danger of a surface coating being damaged, which may result in rust starting and so ruining the whole article. Aluminium is now being largely used in the construction of machines for the canning and textile trades. In the one instance, the good hygienic properties of the metal have made it first choice, while in the other the saving in weight for fast moving parts increases the life and the efficiency. There is still another industry which could absorb many times the present consumption with advantage; this is the shop-building trade. It is to be hoped that this fact will be realised and steps taken to develop the market in the very near future. Another line of development has been the use of aluminium alloys for bearing metals. These examples—and there are many others—show that the field of application is far from being completely developed.

Secondary Metal.

Reference has already been made to the acute depression in prices during the year. This has been partly due to an increased use of remelted metal. There are certain definite openings for castings made in this way, particularly for applications where the higher first cost of virgin metal would prevent the use of aluminium at all and where, moreover, the characteristics required are not high. Unfortunately, this distinction has not been fully considered. In many cases, a lower grade of casting at a cheap price has been accepted where it would have been better for all concerned if the better material at a higher price had been accepted. The popularity of aluminium castings has suffered in the past as a result of indiscriminate use of scrap metal often of unknown origin, and most founders who have been forced to use scrap and secondary metal to maintain their custom know to their cost the pitfalls of this class of material.

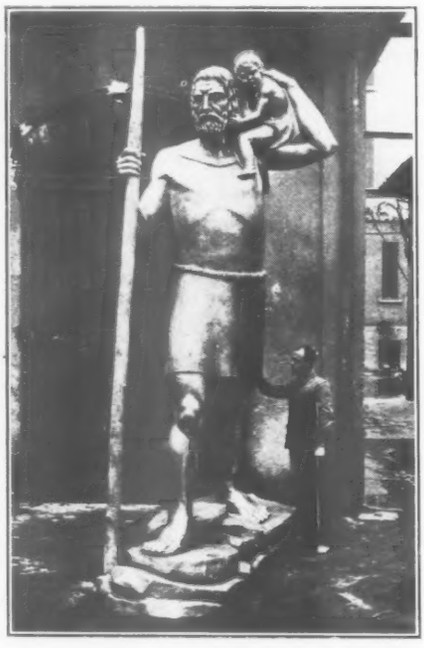


Fig. 3.—A Statue of St. Christopher, 13 ft. 6 in. High, Cast by the Lost-Wax Process. Central Post Office Building, Palermo, Allumino, S.A., Milan.

Some New Alloys.

Abroad the trend in development has been similar to that in England, and the demand for castings, particularly in Europe, is increasing. In Germany, melting practice has undergone a very thorough investigation, with the result, it is claimed, that a general improvement in quality has taken place. Two series of alloys have also been the subject of new research. The first of these is for bearings, and the alloys used are made with special purity metal; the second is a series of magnesium, manganese, titanium containing alloys which it is stated have a high resistance to chemical attack. In both cases the early results are said to be most satisfactory. In France the popularity of titanium is also increasing, and an alloy containing 0.4 per cent. together with 4.5 per cent. copper is widely used. A new field of application has been found in the French bleaching industry, where hydrogen peroxide is being adopted very largely. The fact that aluminium does not discolour the solutions to any extent makes it a suitable material for the construction of vats and other types of bleaching plant. America has been badly hit by the depression, but a welcome revival has come in the last few months, the brewing industry and the railroads being the largest outlets. On the alloy side there has been a flood of new compositions, most of them as yet untried outside of the laboratory, but the strong magnesium alloys already described are well established.

The auspices for 1934 are better than they have been for several years. If the aluminium foundries maintain their reputation for courage and enterprise, then the industry should be the first to benefit by reviving trade.

Catalogue Received.

Alloy Cast Irons.—We suppose that in a hundred years time the catalogue received from Messrs. S. Russell & Sons, Limited, of Leicester, will be a document of true historical value, for we believe that it is the first advertisement publication dealing with the subject of alloy cast irons. In saying that this is the first, we stand to be contradicted, but, if so, it is the fault of the issuing foundry for not sending us along a copy for review. Actually, this catalogue is made up of six leaflets; each, except the first one which is of an introductory character, deals with one definite type of cast iron. Thus, they cover nickel cast iron, nickel-chrome cast iron, Silal, Nicrosilal and Ni-resist (Nimol). The whole is very intelligently set out, especially the questionnaire, and the list of physical properties possible of attainment as set out on the introductory page. One of the questions asked is: "What material was formerly used for this purpose?" This will often enable the foundry to give a material at specially attractive prices to the buyer, yet providing a monetary return, which will go towards paying some of the enormous charges which have had to be incurred before a firm is in the position to enter such a market.

The method employed in each case has been to state the name of the material, to outline its special properties, to state its applications and to illustrate a couple of typical productions.

The make-up in general is excellent, except leaflet F. 12, which is definitely overcrowded. This could have been overcome by "running on" instead of tabulating the composition.

The Work of the Institute of British Foundrymen in 1933.

By C. E. WILLIAMS (President, 1933-34).

WRITING in the corresponding issue of this Journal a year ago, Mr. Victor Stobie reported that the year 1932 had been one of the most active in the history of the Institute of British Foundrymen. This activity in all departments of the Institute's work has been maintained during the year 1933. The new departures which were inaugurated in 1932 and in the years immediately preceding have engaged the attention of a large number of members and much progress has been made. This has been accomplished without any diminution in the volume and quality of the ordinary work of the Institute, which has been continued with unabated vigour.

Scope of Papers.

During 1933 no less than 132 lectures and meetings for the reading and discussion of Papers on topics relating to foundry practice and technology have been held by the Institute in twenty cities and towns. These lectures and Papers may be classified into three groups. The first group consists of Papers dealing with original research and experiment carried out in industrial establishments and in the laboratories of research associations. The value of these Papers, which are generally of a scientific and technical character, lies in the fact that the work with which they deal frequently indicates to the observant founder items which he can incorporate into his own practice, and it is of even greater importance that such work is fundamental to systematic progress and practical development.

Papers of the second type consist largely of a recapitulation of existing knowledge and whilst, perhaps, not announcing new discoveries or setting forth new principles, they are frequently ahead of current foundry practice. Recounting as they do the author's experience and difficulties and his methods of solving those difficulties, the usefulness of such Papers is unquestionable.

The third class of Papers is often referred to as "practical," and describe actual manufacturing methods and operations in the foundry and associated departments. In an Institute consisting largely of members who are intimately concerned with practical foundry problems, it is not surprising that such Papers and lectures are highly appreciated, and an opportunity of hearing them and the accompanying discussions is eagerly sought. Our policy has always been to encourage the discussion of practical subjects, but it is sometimes difficult to secure Papers of this character.

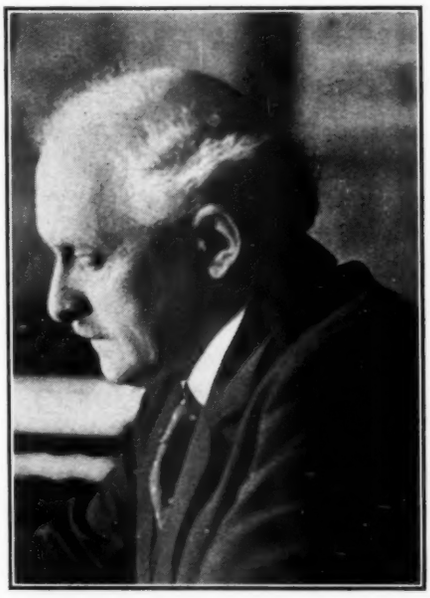
Many foundrymen of wide experience and with considerable knowledge are quite willing to impart their knowledge to their fellows, but they are not always inclined to undertake the literary work necessary to committing their experiences to paper. Those who do take part in our proceedings in this way are among our most useful members, and constant endeavour is made, fortunately with increasing success, to induce others to follow their example.

A new departure in the selection of Papers for the Annual Conferences has been inaugurated recently. Hitherto, such Papers have been arranged principally by invitation to prospective authors. In the near future there will be issued to authors a general invitation to submit Papers of a suitable character, and from the Papers so submitted a selection will be made. The presentation of such Papers, in addition to those obtained by the usual method of invitation, will enable our work to cover an even wider range of foundry practice.

The Institute is deeply indebted to authors of Papers for their work and to the various industrial undertakings, research associations and other organisations with which they are connected for their public-spirited co-operation.

Works Visits.

There is no surer aid to the broadening of a foundryman's experience than the inspection of foundries where similar work, or even work of a character different from one's own, is being carried out. Systematic visits to works are organised at frequent intervals by all the Branches of the Institute, and they form an important feature at the annual conferences. Apart from the direct utility of such visits, which is obvious, they help to break down prejudice and suspicion, and are beneficial both to the visitors and to the firm which is visited, for it is a truism that few firms entertain visitors without learning as much as they impart. The Institute is grateful to all those firms and other organisations which have arranged such visits, and pays tribute to their broad-minded policy.



MR. C. E. WILLIAMS.

Technical Committee's Work.

At each of the two most recent Annual Conferences, a Paper has been presented which was prepared by a sub-committee of the Technical Committee, and at the next Conference, to be held in Manchester in June, it is expected that Papers will be presented by other sub-committees. The publication of such Papers is a logical development of the work upon which the Technical Committee and its sub-committee is engaged. This section of the Institute's work was inaugurated about three years ago, and sub-committees, each covering a particular branch of foundry practice, are in active operation. The departments upon which sub-committees have been at work for some time are:—Cast Iron, Steel Castings, Malleable Cast Iron, Non-ferrous Castings, and Sands and Refractories. A sub-committee on melting furnaces was formed at a later date, and quite recently, a sub-committee on foundry costing, a subject of primary and increasing importance, has commenced operations.

Each of these sub-committees endeavours to review the problems and requirements, on the one hand, and the present state of knowledge on the other hand, of its own sphere of work, and naturally and simultaneously there is a constant endeavour to apply the latter to the practical requirements of the former and to interpret new developments in a manner permitting of ready application to the everyday problems of the industry. This work demands constant perusal of the available data obtained from current literature and from other sources, and it necessitates the continued observation and recording of everyday practice as revealed in the works and in the laboratory. The first results of this work are found in the Papers to which reference has been made, and further Papers of a similar character will follow from time to time. The discussion, and the interchange of opinion among a large body of technicians and practical men which such work involves, is bound gradually to permeate the industry and have far-reaching and beneficial results.

The Technical Exhibit.

Visitors to the Foundry Trades Exhibition which was held in London in April last will remember the technical exhibit which was arranged by the Technical Committee. This exhibit was designed partly to demonstrate the present high degree of progress which has been attained by the foundry trade, and also to act in an educational capacity to the foundryman by pointing out methods of improving his work by the application of science to foundry practice. Each sub-committee of the Technical Committee was responsible for the organisation of one section of the exhibit, and the Technical Committee had the co-operation of the British Non-Ferrous Metals Research Association and of a number of firms engaged in various branches of the industry.

Pointing out, as it did, the almost revolutionary improvements which have been achieved in foundry practice in recent years, the exhibit was a useful medium of propaganda for the industry. From a domestic point of view, it is satisfactory to note that over thirty new members of the Institute were enrolled as a result of the interest in the Institute's own work which was aroused. Advantage is taken of this opportunity of acknowledging to Messrs. F. W. Bridges & Sons, Limited, the organisers of the exhibition, and to the Foundry Trades Equipment and Supplies Association, our indebtedness to them for the facilities afforded for the exhibit.

Foundry Education.

In April and May the second annual examinations in foundry practice and patternmaking were held by the City and Guilds of London Institute. These examinations were inaugurated on their present basis at the suggestion of the Institute of British Foundrymen, and they are conducted in conjunction with an Advisory Committee on which the Institute is strongly represented; this Advisory Committee was also responsible for the drafting of the syllabuses. The number of candidates who presented themselves for examination in the subject of foundry practice and science was 53, an increase of three upon the number of candidates in 1932. In the Patternmaking Intermediate Examination there were 36 candidates, an increase of 21 on the previous year's number, and in the Final grade in the same subject the number of candidates was 10, an increase of two upon the 1932 figures. The percentage of passes in the Patternmaking Examinations was higher than

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in 1932, but was slightly lower in the subject of foundry practice.

The whole of the certificates granted to the successful candidates were endorsed by the President of the Institute of British Foundrymen, and a number of certificates in the same subject of similar standard submitted by the Union of Lancashire and Cheshire Institutes were also endorsed.

The President of this Institute also endorses, in respect of special subjects relating to foundry work, the National Certificates in Mechanical Engineering issued by the Board of Education and the Institution of Mechanical Engineers. Twenty-seven of these certificates were endorsed in 1933, making a total of 68 since the inauguration of the arrangement some three years ago. Fifty-nine were in the Ordinary grade, and nine in the Final grade.

New Requirements.

An increasing number of Technical Colleges are arranging classes for the preparation of candidates for these various examinations, and further progress is only limited by the number of apprentices and others who are willing to avail themselves of the opportunities now provided. The co-operation of employers, managers, foremen and others who are in contact with suitable candidates is desired in order that the facilities for technical training which now exist in our industry may be utilised to the full. Foundry work has always been a craft, additionally it is now a science, and the mastery of a science demands study. The ability to meet, in a competitive manner, the exacting requirements which are imposed upon the modern foundryman, can only be assured by the provision of a trained personnel, and the further progress of the industry demands that the young foundryman shall undergo the training that is now available. Furthermore, his own personal progress is also dependent upon his technical training as much as upon his practical experience.

THE INSTITUTE OF BRITISH FOUNDRYMEN.

OFFICERS, 1933–34.

PRESIDENT:
C. E. Williams.

VICE-PRESIDENTS:
R. W. Stubbs; J. E. Hurst.

PAST-PRESIDENTS:
R. Buchanan. (Deceased.) 1904–1905.
H. Pilkington. (Deceased.) 1906–1907.
F. J. Cook, M.I.Mech.E. 1908–1909.
P. Longmuir, M.B.E., F.Met. 1910–1911.
C. Jones. (Deceased.) 1912.
S. A. Gimson. 1913–1914.
W. Mayer. (Deceased.) 1915.
J. Ellis. (Deceased.) 1916–1917.
T. H. Firth. (Deceased.) 1918.
John Little, M.I.Mech.E. (Deceased.) 1919.
Matthew Riddle. 1920.
Oliver Stubbs, M.I.Mech.E. (Deceased.) 1921.
H. L. Reason, M.I.Mech.E. 1922.
Oliver Stubbs, M.I.Mech.E. (Deceased.) 1923.
R. O. Patterson. 1924.
J. Cameron, J.P. 1925.
V. C. Faulkner, M.Inst.M. 1926.
J. T. Goodwin, M.B.E., M.I.Mech.E. 1927.
S. H. Russell. 1928.
Wesley Lambert, C.B.E. 1929.
F. P. Wilson, J.P. 1930.
A. Harley. 1931.
Victor Stobie, M.I.E.E. 1932.

HON. TREASURER:
W. B. Lake, J.P.

TRUSTEES:
F. J. Cook, R. O. Patterson and A. Harley.

GENERAL SECRETARY AND GENERAL OFFICE.
T. Makemson, Assoc.M.C.T., St. John Street Chambers, Deansgate, Manchester.

Sheffield University.

Advanced training in foundry technology leading to the conferment of a degree, is proposed in a scheme prepared by Prof. Andrew, of the University of Sheffield, in co-operation with the authorities of that University. The Institute has always supported any proposal which appears likely to increase the usefulness of the foundry technician, and it is awaiting the development of this scheme with considerable interest. A Committee of the Institute is engaged in investigating the proposals with a view to recommending methods of active co-operation between the University of Sheffield and the Institute.

International Relationships.

Few technical organisations have closer relations with similar organisations in other countries than this Institute. At the Annual Conference held in Cardiff in June last, Papers were given by representatives of the American, French and German foundry technical associations, and representatives of this Institute presented Papers at the Annual Conferences of the French and American Associations. Since the system of exchange Papers was established in 1922, no less than thirty-four Papers have been given to us by representatives of the European and American Associations, and in return our own members have presented thirty Papers to the Conferences of these Associations.

These international relations are further cemented by visits of the foundrymen of the world to International Foundrymen's Conferences. The most recent of such Conferences was held in Czecho-Slovakia, and the Institute was represented by a party of twenty members and ladies, led by two Past-Presidents, Mr. John Cameron, J.P., and Mr. Vincent C. Faulkner. The value of internationalism in foundry technology was recognised by President Masaryk, who honoured the Conference by receiving a small deputation of members of the International Committee of Foundry Technical Associations. This deputation included Mr. John Cameron, and Mr. T. Makemson in his capacity as honorary secretary of this Committee. The international character of our own membership is indicated by the fact that three other members of this deputation of seven are members of this Institute, namely, Mr. Delport, the American representative, Mr. Léonard, President of the Belgian Association, and Prof. Pisek, the President of the Czecho-Slovakian Association.

The Annual Conference.

The Thirteenth Annual Conference was held in June at Cardiff, and was attended by about 250 members and ladies. The Conference was opened by the Lord Mayor, Alderman C. F. Sanders, J.P., who was also present at many of the Conference functions, along with the Lady Mayoress, Miss Muriel Sanders. The Institute is deeply indebted to them for their interest, and particularly for the reception they gave in the City Hall on the day preceding the opening of the Conference.

The success of the social activities of this Conference was due in no small measure to the Principal and Council of the University College of South Wales, who allowed the members and ladies to inspect the College and entertained them to an enjoyable social evening.

Several Papers of value to various sections of the industry were presented at the Conference sessions, and the educational value of the gathering was enhanced by visits to a number of representative works, to the directors, managements and staffs of which the Institute tenders its sincere thanks.

We are also glad to acknowledge our indebtedness to the South Wales Institute of Mining Engineers, who allowed us to use their building for the Conference meetings. Lastly, the writer would express the Institute's gratitude and his own personal thanks to the officials of the Wales and Monmouth Branch of this Institute, who organised this large and successful gathering in spite of many handicaps due to geographical situation and trade conditions.

Membership of the Institute is voluntary, and is dependent upon the enlightened point of view by which it is viewed by the individual. During 1933 a few members have had to relinquish their membership, due to the severe trade depression of the previous year, but their number is much smaller than might reasonably have been anticipated. Many of these members will return when opportunity permits, and we are anxious to enrol new members in order to maintain and increase our strength and our usefulness.

The management of the Institute is carried on as economically as possible, but the increased work which is now undertaken for the benefit of the industry as a whole necessitates increased expenditure in certain directions. Although at the time of writing the accounts for the year have not been completed, it is anticipated that, in spite of this increased expenditure, the income will have balanced the expenditure.

Membership of a professional organisation is essential to every man holding, or hoping to hold, any position of responsibility, and this is even more true of the foundry industry than of many others. The value of the benefits which are received is much greater than the small subscription which is paid; furthermore, everyone in the industry derives assistance directly or indirectly from the Institute's work, although he may not always be aware of it, and he is therefore under a moral obligation to contribute his quota of support.

THE INSTITUTE OF BRITISH FOUNDRYMEN.

Members.

Honorary	16
Members	735
Associate Members	941
Associates	113
Subscribing Firms	52
Total	1,857
Branches	10
Sub-sections of Branches	5
Junior Sections	1
Committees of General Council	6
Technical Committee and sub-committees	9
Branch meetings during 1932	132

Papers presented.

Cast Iron	29
Steel Founding	8
Non-ferrous	10
Moulding and Patternmaking	12
Mechanisation	9
Sands and Refractories	10
Furnace Design and Practice and Fuels	10
General Discussions	8
Miscellaneous	20
Total	116
Nationalities represented in membership	11
Countries in which members are resident	17

Finance.

Invested funds	£1,700
Bank balance	400
Total	£2,100

One cannot be President of this Institute without realising with admiration the enormous amount of devoted and unselfish work which is unstintedly carried out by the various officials, members of committees, and the general body of members. One also learns to appreciate the value of the co-operation of THE FOUNDRY TRADE JOURNAL, of its proprietors and of its editor, Mr. V. C. Faulkner.

The Institute is a live organisation, and is keenly aware of the necessity of taking advantage of every new development, and this receptiveness can be traced to the fact that there is probably a greater body of members doing active definite work than in perhaps any other similar organisation. The Branch-Presidents and secretaries carry out a vast amount of administrative work voluntarily and in their own time; members of the Council and committees, particularly of the Technical Committee, travel long distances at frequent intervals to attend meetings, at their own expense, and carry out much work by correspondence. Surely an Institute which has its foundation upon public-spirited and disinterested service such as this, is worthy of the support of every member of the industry which it represents.

Trade Conditions in 1933 in the Grey-Iron Foundry Industry.

By WILFRID H. HARPER (John Harper & Company, Limited, Willenhall).

IT is a far more agreeable task to the writer to contribute such an article at the present time than it would have been at the end of any of the last three preceding years. As each of those years drew to a close, we all hoped that things had touched bottom, and taxed our optimism to the full in looking forward to better times. Those better times, however, did not materialise, and from the end of 1929 to this time last year trade conditions took a downward path.

The year 1933 opened without any immediate change, but after the first quarter definite signs of improvement became manifest. Since that date there has been a continual upward trend in the grey-iron industry. With over 500,000 men off the unemployed register, and many others who were previously on short time now working a full week, one can safely say that all those engaged in the production of grey-iron castings are to-day in a far more cheerful state of mind than they were at this time last year.

The following table, published by the National Federation of Iron and Steel Manufacturers, tells its own story:—

	Pig-iron. Tons.
1929—average monthly production	632,400
1930— " " "	516,000
1931— " " "	314,400
1932— " " "	297,800
1933—January	286,600
February	270,800
March	332,700
April	324,700
May	339,900
June	345,600
July	343,900
August	362,700
September	359,700
October	373,300

The uncontrolled economic conditions of the last three years have left their mark on the foundry industry. The excess of supply over demand maintained a buyer's market, and competition became more and more intense. Many foundries supplied castings at a figure which showed no relation between production costs and selling prices; they were not only gradually killing themselves but they were (and some still are) a menace to the industry in which they are engaged.

One of the largest foundry-plant suppliers in Great Britain reports that during the past seven years at least 500 foundries have gone out of business. Let us hope that the return of confidence will bring with it a return of sanity to those price-cutters who indulge in selling castings at a figure under their production costs.

THE FOUNDRY TRADE JOURNAL has, on several occasions, done very good work in coming out strongly on the subject of the senselessness of price-cutting.

On the other hand, many foundries have benefited. In order to exist under such searching conditions, they have been continually improving their methods of production and eliminating their waste; with better conditions in sight they will certainly be rewarded.

The Fiscal Change.

As with many industries, the foundry trade is feeling the advantages of the recent change in our fiscal policy. Continental and American manufacturers who previously exported their finished products to this country are now manufacturing here and buying their castings from our foundries.

Another good sign is that many of the specialist foundries who, during the last three years were forced by slack trade to go outside their own field of work, are now dropping this extra business, which is returning to its original makers. Also, many of our own industries have expanded since they have been protected from foreign goods being landed and sold in this country at uneconomic prices.

Those production foundries supplying the automobile and automobile-accessory trade have had a busy year making large quantities of accurate castings at very keen prices, and there appears to be reasonable ground for believing that the

MR. W. H. HARPER.

demand will be maintained for some time to come. Certain sections of the electrical trade are slack, owing to the completion of the national grid system. The inroads made by pressings in switchgear work, and the use of welded steel in place of large single castings have made themselves felt in the heavy jobbing foundries. In the domestic field of work, however, large tonnages of castings have been made for electric fire and cooker work, heat-resisting cast iron playing an increasingly large part in the latter. The gas industry has absorbed an increasing tonnage of castings in both its industrial and domestic branches, and is assured of ample work for many months to come.

Shipbuilding, perhaps, shows the fewest signs of improvement. Even though the big Cunard liner is to be restarted—the main castings for which are already made—the future is not very bright, because of the serious diminution in international trade.

It is impossible to name all the trades showing an increased tonnage of grey-iron castings, but mention may be made of lawn mowers, typewriters, dairy machines, tabulating machines, petrol pumps, traffic controls and the artificial-silk trade.

During the year both production and jobbing foundries have had inroads made into their products by the introduction of welded structures, stampings, die castings and plastic products, but, taken as a whole, this loss of work has been more than counterbalanced by the penetration of alloy iron in heat-resisting and high-tensile developments. There are now several rotary furnaces installed, producing castings which only a few years ago would have been considered outside the range of cast iron. Foundry suppliers report record sales of moulding plant and general equipment, and orders have been placed for at least six continuous plants for rain-water, gas and electric work.

The Sand Rat.

A contribution of this nature would not be complete without paying a tribute to that patient and much-tried individual—the British moulder—who, of late, has had a very rough time walking the streets in search of work and too often meeting that discouraging sign "No Vacancies." It is to be hoped that with the return of normal conditions he will have full opportunity of exercising the skill for which he is still world famous.

The immediate prospects for 1934 appear to be reasonably good, but the uncertain conditions prevailing throughout Europe, the United States, and, in fact, the whole world, make it impossible for anyone to see clearly ahead for any great distance. One can only hope that he who writes these notes next year will be able to report that during 1934 trade conditions continued to improve.

New Year Gifts Received.

We acknowledge with sincere thanks the receipt of the following presents, and take this opportunity of reciprocating the expressions of good will which they contained:—From BRITISH PIGIRONS, LIMITED, a perpetual desk calendar—a really useful and ingenious contrivance; THE BRITISH CHILLED ROLL & ENGINEERING COMPANY, LIMITED, combined desk blotter and engagement diary; SPENCER & HALSTEAD, LIMITED, combined desk blotter, engagement diary and note pad; DEMAG, refill for day-to-day desk calendar; H. G. SOMMERFIELD, LIMITED, desk engagement diary, a week to the page; CRAVEN BROTHERS, LIMITED, wall calendar, three months to the page, the current month being printed in red; SMITH & FAWCETT, wall calendar; HARGREAVES BROTHERS, wall calendar; CROFTS, LIMITED (BRADFORD), wall calendar; FURNISTON & LAWLOR, novelty desk calendar, with adjustable day indicator; W. & J. F. JONES, LIMITED (PENDLEYBURY), wall calendar, carrying picture of "The Goose Girl" printed on silk; LIVERPOOL ELECTRIC CABLE COMPANY, LIMITED, wall calendar with picture of a sunset over Liverpool Bay; H. HENDEN & SON (CROYDON), wall calendar showing pretty girl holding a kitten; STABILIMENTO GRANDI MOTORI F.I.A.T. (TURIN), wall calendar, two months to the page, carrying illustrations of the firm's productions; STEWARTS AND LLOYDS, LIMITED, leather-bound pocket diary, four days to a page; I.C.I. METALS, LIMITED, leather-bound pocket diary with window for season ticket, four days to a page; CLAY CROSS COMPANY, LIMITED, leather-bound pocket diary containing much useful data and other descriptive matter, five days to a page; THOS. W. WARD, LIMITED, leather-bound pocket diary, containing useful

(*Concluded on page 55.*)

The Italian Foundry Industry in 1933.

By Dr. GUIDO VANZETTI (Managing Director of the Vanzetti (Milan) Steel Foundry).

ON examining the production statistics for steel castings in Italy for the first 11 months of 1933, it will be noticed that this production was slightly below that of 1932. If, however, the trend of the production for that year is observed, it will be seen that it was subject to important fluctuations, with a tendency towards improvement during the last months, an improvement which compensates the very small production during the first half-year, which is exceptionally meagre. This tendency towards improvement cannot be attributed to the revival of any particular industry employing steel castings, but rather to a slight general improvement in the situation of Italian industry as a whole. Prices continue to drop unrelentingly. However, during the last months, it has been noticed that the downward curve is not so sharp and tends towards greater stability.

A production of about 40,000 tons of steel castings is forecast against 42,000 for last year, about half of which are turned out in Lombardy, one-quarter in Piedmont and Liguria, and one-quarter in the other Italian districts.

With regard to grey-iron castings and those of non-ferrous alloys, much the same can be said about these as for the steel castings. The statistics in this connection are not very precise, because the production is divided up between an enormous number of foundries, of which the greater part is made up of small concerns having but few workpeople.

It can, however, be stated that the revival of activity in the building line has brought about a greater demand also as regards last year, of material for heating plants, stoves, cooking stoves, and sanitary appliances. The production of malleable cast-iron castings has also undergone a slight increase, although it is still on a considerably reduced scale as compared with the productive capacity of the specialised foundries.

Although, on account of the difficulties of the moment and the scarcity of money, all have tried to economise to the utmost, avoiding the locking up of capital in fresh installations; yet, in order to overcome competition, several foundries have found it necessary to bring their plants up to date.

Therefore, as a result of this crisis, at least one advantage will be gained—a selection of the soundest organisations which will emerge victorious from the struggle by being better organised and better equipped.

Lately, a law has been passed which forbids the installation of any new plant whatsoever without the authorisation of the Ministry of Corporations. A special Commission of experts give judgment as to whether or not such authorisation should be granted based on the condition or situation of the industry and market as regards that particular field for which the new

DR. GUIDO VANZETTI.

plant would be destined to serve. It is to be hoped that in the case of our own field, no permit may be granted for the installation of new foundries, although even to-day there still exist some who have the intention to take such a sorry step!

Attempts are still being made to come to an agreement between the various steel foundries in the matter of prices, but so far no result has been achieved. It is very much hoped that the reform of the section Guilds, announced in November last by the Prime Minister, may be the means of bringing a little order and discipline into industry and the Italian market, especially in the foundry trades.

At present the standard specifications for steel and cast-iron castings are under discussion. In spite of the fact that the question has been debated for many months past, no conclusive result has yet been arrived at, particularly on account of the continued resistance on the part of some of the representatives of the consumers who think they can cause progress in the technique of foundries simply by making specifications more rigid and increasing the figures relating to the mechanical characteristics of metals. The variety and opposition of interests which are in play in these discussions certainly do not hasten the conclusion, but it is certain that an agreement will be arrived at within a short time now.

To-day the point most discussed in connection with steel castings is the question of the resilience, which, whilst being accepted by the manufacturers in the case of steel of higher quality, has not been well received by them as decisive test for the acceptance of an ordinary steel.

Another point of discussion in connection with steel castings is the question of the taking of the test-bars. Some demand that this test-bar should, as a general rule, be taken from the mass of casting; the foundries are opposed to this, and agree to such a test only in exceptional cases, and with mutual agreement between the customer and the supplier as to which part of the casting the test should be taken.

A similar question is being discussed with regard to cast iron, where, on the whole, there is an agreement for the demand of transverse and tensile-strength tests, but there is no agreement as regards the methods of taking the bars.

Summing up, it will be noticed that the Italian foundry industry is going through a period of settling down and of reorganisation in readiness for the revival. Although one may not be led to consider as symptoms of a real revival the increase of production of the latter months, yet one may hope that at least we have come to the end of the downward course, that the bottom has been touched, and that preparation is being made for a revival.

The French Foundry Industry.

By MAURICE OLIVIER (President of the French Foundry Employers' Federation).

IN the past two years French industry, and the foundry industry in particular, has been passing through an extremely grave crisis. Since I took over the Presidency of the French Foundry Employers' Federation, on the much to be regretted death of the late Mr. Charles Dufour, I have closely studied this problem and have come to the conclusion that the situation cannot be bettered without seriously considering the whole question of the organisation of our industries.

For many years we have been living in an atmosphere of confusion, I might even say anarchy. Everybody produces as he likes, without considering the next man, either in relation to quantity or selling price. This deplorable method results in an unbalanced state of affairs which ruins alike the market and the individual, and has disastrous economic consequences.

At the present time, it is essential that everybody should put aside his individualistic sentiments and adapt himself to circumstances. Persisting in living in isolation in a time of absolute economic liberalism is to ask for disaster.

It is necessary in order to restore order in the industry, and here, on this subject, it is my own opinion that, despite those founders of whom I have already had occasion to speak, a market is essentially a matter of:—(*a*) Consumption; (*b*) production.

On the question of consumption, action by the founders is definitely limited, for it is difficult to add to it in our industry, but the needs of the consumer are in another category. However, it is possible to adjust production to the needs of the consumer and it is there that there must be discipline, without which nothing can be done.

It is personal opinion that all work must be remunerative: that of the designer who makes the plans, that of the workman who carries them out, that of the employee who controls and co-operates in the sale, as well as that of the employer who directs, lays out his capital, and takes all the risks of the enterprise.

At the present moment in the foundry we

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Railway Foundry Mechanisation.

By E. A. W. TURBETT (Manager of the Locomotive, Carriage and Wagon Works, Eastleigh, of the Southern Railway).

THE question of mechanising a railway foundry is one which offers great possibilities of economy on the one hand, coupled with a large number of problems which must be overcome if these economies are to be fully realised. The economies expected from such a scheme, as is the case for any mechanisation, aim at: (1) The elimination or reduction of unproductive operations; (2) the acceleration of the productive operations, and (3) the improvement in the quality as well as the quantity of the output. Starting from the basis of an ordinary type of foundry employing hand moulding, the first step in mechanisation is the substitution of machine moulding where possible and economical.

In connection with railway foundry work in particular, this latter point is important, because such a foundry has to cater for a large volume of repair work as well as new construction, and in most railway works the repairs output considerably outweighs the new work. These repair orders—with certain well-defined exceptions—are usually for comparatively small quantities, and, unless a large amount of capital is to be tied up in stores stock, this cannot be avoided, and the problem is to select those items which are most likely to pay for being brought under the scheme of mechanisation.

Under the heading of the well-defined exceptions mentioned above, that is, those castings for which the orders are usually considerable, may be mentioned:—Carriage brake blocks (refill or solid types); locomotive brake blocks; locomotive firebars, and wagon axleboxes and certain similar articles.

The question of selection for machine moulding being settled, it remains to collect the moulding machines together and surround them with some form of plant which, as mentioned before, will (1) eliminate or reduce unnecessary operations and (2) speed up the necessary operations. Taking now, as a basis, the ordinary moulding machine set down anywhere in the foundry, the main items of unnecessary labour which the scheme sets out to eliminate or reduce are as follow:—(1) The manual shovelling of sand from floor to moulding box; (2) the transport of the finished mould from the machine to the site on the floor where it will be poured, a distance which increases with the production of moulds; (3) the transport of molten iron from the cupolas to all parts of the foundry; (4) the transport of the finished casting to the fettling shed; (5) the re-transport of the used sand back to the moulding machine; and/or (6) the re-transport of used sand for reconditioning; (7) the re-transport of the empty moulding boxes to the vicinity of the moulding machine, and (8) the transport of cores from the core ovens to various parts of the foundry. With the elimination or reduction of these eight items comes the sequence of the speeding up of the necessary operations.

The third point aimed at is the improvement in the quality of production. This is partly effected as a result of the change over from hand to machine moulding, but in the mechanisation scheme to be described a further improvement is effected by the complete scheme of sand recon-

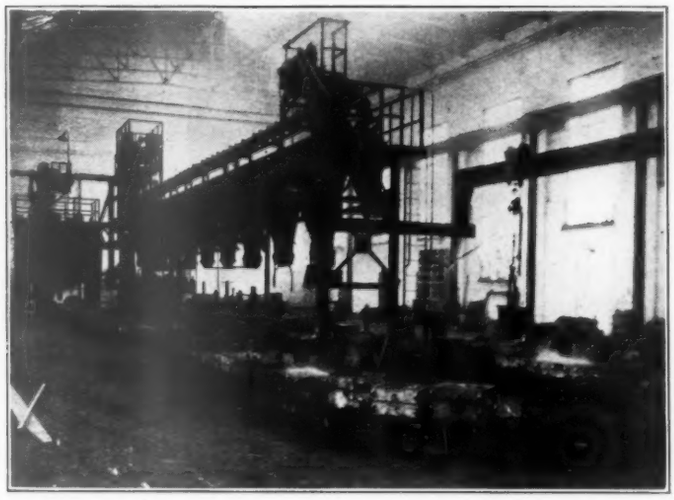

FIG. 1.—GENERAL VIEW OF MECHANISED LAY-OUT.

FIG. 2.—POURING STATIONS.

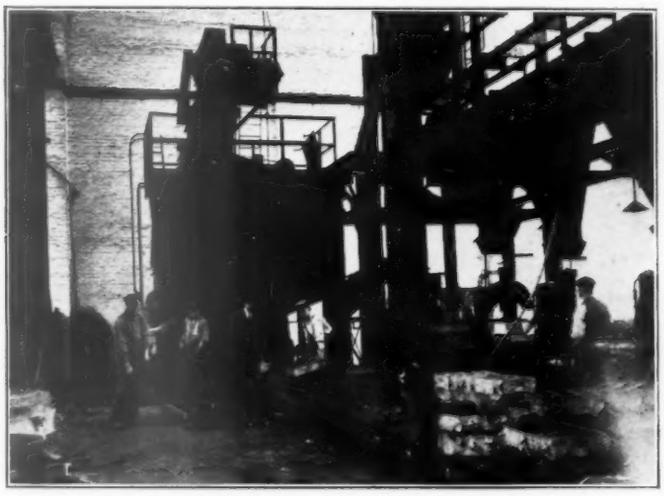

FIG. 3.—KNOCK-OUT GRID WITH NO. 1 ELEVATOR, AND COOLING HOPPER IN BACKGROUND.

FIG. 5.—TOP OF FLIGHT CONVEYOR, WITH HOPPER DOORS UNDERNEATH.

ditioning which results in each moulder receiving a supply of 100 per cent. reconditioned sand, delivered to him in a predetermined state and not to suit individual fancy.

A Typical Scheme.

A typical scheme adopted to cover the improvements set out above is as follows: the selected moulding machines are placed in a row and surrounded by a belt conveyor travelling at 12 ft. per min. This conveyor travels past the fronts of the machines to a point conveniently adjacent to the cupolas, and then returns on a parallel course behind the machines to make a complete circuit. Usually these machines work in pairs, one machine of each pair doing the top half-boxes, and the other the bottom half.

The moulds when made are merely moved from the machine table to the conveyor, thus saving considerable labour in transport. The conveyor next passes a core bench, where a semi-skilled man inserts the necessary cores, the movement of the conveyor being sufficiently steady to permit of this being accurately done. The transport of cores is thus concentrated to one point. The moulds next pass conveniently adjacent to the cupolas, and are there poured as they pass. As before, it is found that the smooth running of the conveyor presents no particular difficulties in the pouring.

The conveyor, carrying the now full boxes, then turns through 180 deg. and passes back along the backs of the moulding machines until it reaches the opposite diagonal corner to the pouring site. Here the clips and runner bushes are removed, and the boxes tipped off the conveyor on to a grid at floor level. The castings are here raked out, the sand falls through the grating to the first operation of reconditioning, and the castings are placed on a slat conveyor, which passes below floor level to an elevator which deposits them in the adjacent fettling

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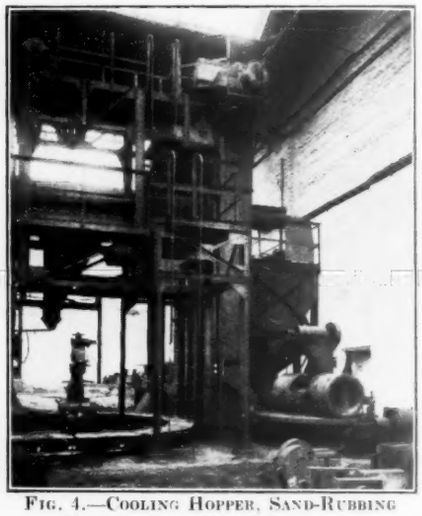

Fig. 4.—Cooling Hopper, Sand-Rubbing Machine, and No. 2 Elevator.

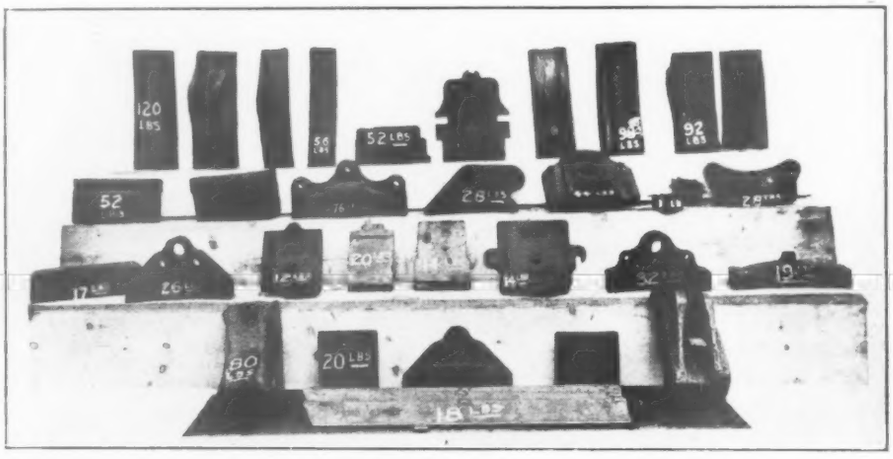

Fig. 6.—Typical Production.

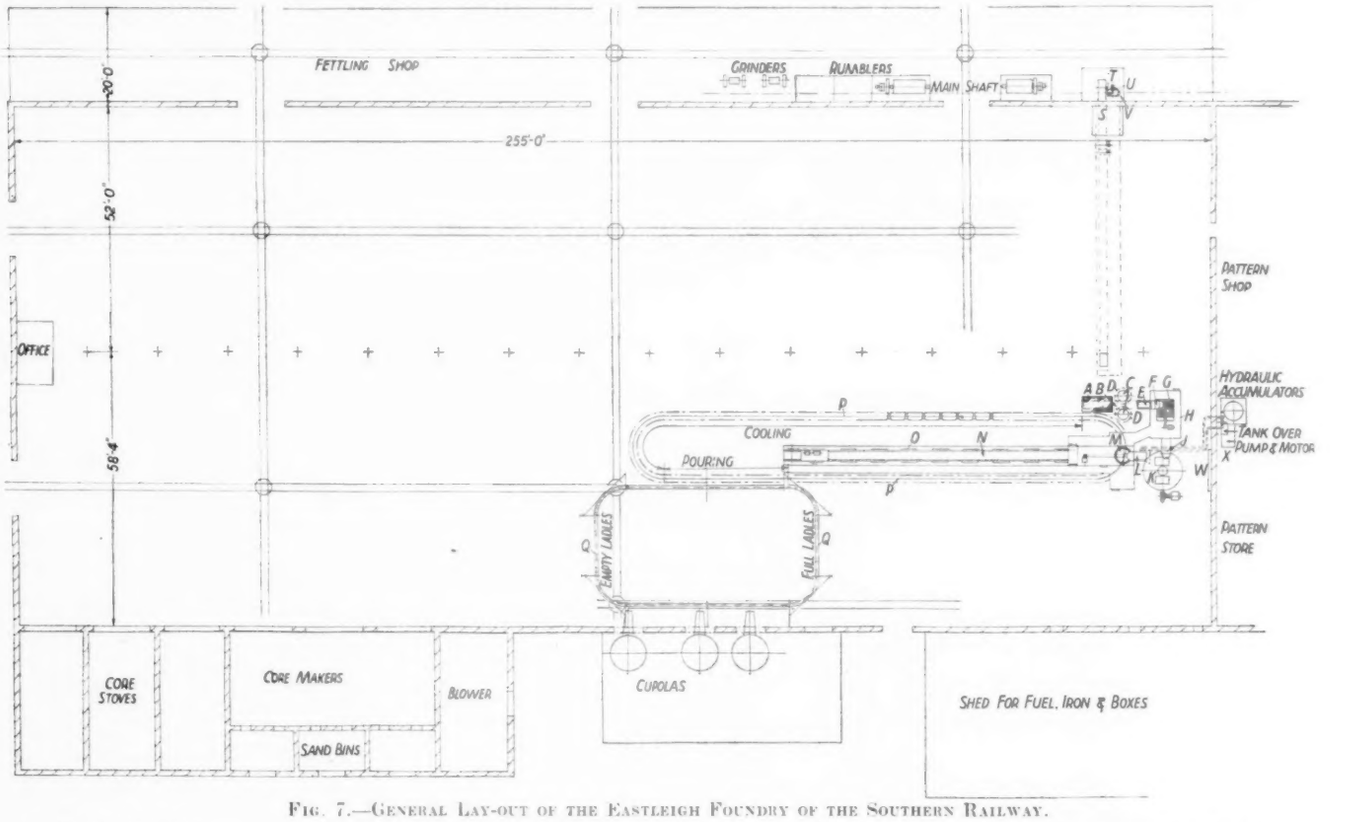

Fig. 7.—General Lay-out of the Eastleigh Foundry of the Southern Railway.

A—Knock-out Grid.
B—Apron Plate Conveyor.
C—Sand and Coal-dust Hoppers.
D—Sand and Coal-dust Feed Plates.
E—No. 1 Elevator.
F—Magnetic Separator.
G—Vibratory Riddle.
H—Storage Hopper.
J—Inclined Belt Conveyor.
K—Mill.
L—No. 2 Elevator.
M—Disintegrator.
N—Flight Conveyor.
O—Hopper (10) over Moulding Machine.
P—Mould Conveyor.
Q—Runway for Ladles.
R—Hot Castings Conveyor (under floor).
S—Hot Castings Elevator.
T—Sorting Platform.
U—Reduction Gear.
V—Belt Drive.
W—Motor Control Panel.
X—Hydraulic Pumping Plant.

Foundry Research in 1933.

By MAJOR F. A. FREETH, O.B.E., D.Sc., F.R.S. (President, British Cast Iron Research Association).

ANY review of foundry research in 1933 must to some extent deal with the work of the British Cast Iron Research Association, but it is not necessary in this matter to go into great detail, since the larger part of the Annual Report and the Annual Meeting for the year ending June 30, 1933, was given in issues dated November 2 and November 9, 1933. For the convenience of those who wish to make fuller reference to original sources, such of this work as has been published may be considered. During the year the Association published recommended methods for the sampling and analysis of cast ferrous metals and alloys.[1] The object of this publication was to provide methods of recognised merit and general value for use in acceptance tests, which might in the course of time become standard, and the adoption of which will assist in minimising difficulties between makers and users of ferrous material. Pig-iron and cast iron present considerable difficulties to the chemist, due to heterogeneity of structure, sometimes accidental and sometimes brought about by the circumstances of manufacture. For example, the change in the structure of white-heart malleable from edge to centre is well known, involving change in the amount of carbon present. The greatest care is therefore required in the sampling of these materials, and this can be assisted by the adoption of similar methods of examination by different chemists. The publication mentioned covers the sampling and analysis of any ferrous metal, whether iron or steel, and includes the whole range of elements which are found in modern materials, including such additions as nickel, chromium, copper, vanadium, titanium, tungsten, molybdenum, cobalt, aluminium. In addition, it gives details of the method of preparation of samples for microscopic examination. The report has been widely reviewed both in this country and abroad, and has been accepted as authoritative. A French edition is in the press.

The Association has also collaborated with the Institute of British Foundrymen in the preparation of a pamphlet[2] giving microstructures of a group of irons with a view to enabling foundrymen to see the general character and distribution of the micro-constituents in cast iron, the graphite, pearlite, ferrite, cementite, phosphide and sulphide. This publication is, of course, not intended to set up standards, for the microstructure of cast metal may vary appreciably from point to point in a section, and from one section to another. It may conveniently be added here that the bulk of the references in the bibliography to this Journal comprise Papers presented to the Institute.

Heat-Resisting Irons.

At the Cardiff Convention of the Institute of British Foundrymen in June, Mr. E. Morgan gave a comprehensive Paper[3] on heat-resisting cast irons, dealing with growth and scaling and with the irons low in silicon, high in silicon (Silal), the alloyed irons low in nickel and chromium and with the austenitic irons, Niresist and Nicrosilal. In a review given towards the close of the year by Mr. J. R. Handforth[4] surveying modern foundry developments as a whole, the introduction of austenitic cast irons is described as the most remarkable change in the ironfoundry industry. These materials are now in regular ordinary commercial production and are being applied in new directions every day. Thus the use of Nicrosilal moulds for die castings was described in this Journal as recently as December 7, 1933. An interesting illustration of the Empire aspect of these developments was given in an article by Mr. A. Crawford[5] in an Australian Journal. This describes the success which has attended the use of Silal in Australia, giving comparative lives of various types of castings and generally confirming experience in this country. The author, a director of a firm now making the material, says "its discovery has marked a new era in the production of heat-resisting irons."

In a Paper to the Chicago Convention of the American Foundrymen's Association, in June, 1933, Dr. A. L. Norbury and Mr. E. Morgan[6] summarised the properties both of Silal and Nicrosilal. Silal furnishes an interesting

MAJOR F. A. FREETH, O.B.E., D.Sc., F.R.S.

example of the complete reversal of view which is sometimes brought about by scientific research. Prior to its development, silicon was definitely regarded as bad for heat-resisting irons and, indeed, within certain limits it is so on account of its tendency to increase the size of the graphite. Silal, however, demonstrated beyond any doubt that, provided a fine graphite structure can be maintained, silicon is definitely advantageous in the cast irons as it is in the steels.

Welding.

A Paper by Mr. J. G. Pearce to the Institution of Welding Engineers[7] dealt with some metallurgical considerations in the welding of ferrous alloys. The desirability of structural homogeneity was stressed, and the structural changes due to welding through the use of different types of welding rod were shown. It was pointed out that metal deposited in a weld is essentially a casting. The special advantages of the above-mentioned heat-resisting irons, Niresist and Nicrosilal, in welding were also pointed out. They owe their advantages largely to their freedom from oxidation at high temperatures, to a measure of ductility and to the comparatively low carbon content. It is generally recognised that difficulties arise in welding steels over 0.3 per cent. carbon. Ordinary cast irons contain much more than this quantity. It was suggested in this Paper that the difficulty of welding ordinary cast iron arises not, as is commonly supposed, from graphite, but from carbide, which reacts with any oxides which may be present to produce gases much more readily than graphite, which is an extremely stable material. The austenitic irons do not contain free carbide, and are coming into use in the form of welding rod. In a short article, the same author[8] explodes a fallacy with respect to ordinary grey iron which has been prominently featured in text-books for about eighty years. This is the idea that sharp corners in castings contain a zone of weakness through the meeting, on the diagonal plane through the corners, of the two groups of crystals formed during solidification at right-angles to the sides bounding the corner. The reasons for the avoidance of corners in casting designs were given, but the existence of this plane of weakness is not one of them. Castings, in fact, seldom break through a sharp corner, and deliberate fracture does not usually reveal the weakness referred to. Certain non-ferrous castings, steel castings and white castings, however, are much more liable to it.

Cupola Practice.

With reference to the balanced-blast cupola, during the year independent statements by users with results achieved have been published in two cases, by Mr. H. H. Shepherd[10] and Mr. E. Wharton.[11] Mr. Shepherd gave full details of the cost of conversion and subsequent running costs of a small cupola used for the melting of black-heart malleable and of another cupola used for grey iron. In the former cupola it was found that the installation resulted in a net reduction of the cost of metal at the spout of 2s. per ton, the installation costs being paid for in less than seven weeks' operation. In the latter case the figure was 2s. 3d. per ton, but, being a larger cupola lined down, the costs were paid off in eleven weeks' working. The time taken to pay off costs out of savings naturally depends on the throughput, but it is generally agreed among manufacturers that a capital expenditure justifies itself if it can be met out of savings within two years. Mr. Shepherd has since stated in a letter (THE FOUNDRY TRADE JOURNAL, July 6, 1933) that the sulphur pick-up from a balanced-blast cupola is 50 to 60 per cent. of that of a correctly-controlled ordinary type of cupola.

Mr. Wharton's Paper gave figures for coke consumption on a pair of twin 33-in. balanced blast cupolas for grey iron melting, the coke consumption being 15:1, excluding the bed.

The total number of cupolas installed or under construction on the balanced blast system to the end of 1933 is fifty, having an aggregate tonnage output of 335 tons per hr. While in difficult times the coke economy is important as enabling the necessary construction costs to be met out of savings within a reasonable time, it is generally considered that the particular advantage of this cupola lies in the high temperature of melting and the comparative freedom from oxidation. The latter is shown in part by greater freedom from foundry defects and in part by the very low proportions of carbon monoxide in the gases at the charging door. The extent of the conversion of the carbon in the coke to carbon dioxide is a measure of the amount of available heat extracted from the fuel. A high proportion of carbon monoxide in the exit gases indicates very great loss of available heat. Thus while a balanced blast cupola gives 1 per cent. or 2 per cent. of CO in the exit gases, it is usual to find ordinary cupolas giving 4 per

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cent. to 10 per cent., and figures up to 20 per cent. are by no means common. Towards the end of the year Mr. L. W. Bolton gave a Paper to the Institute of British Foundrymen, London Branch[12], on modern cupola practice, which provoked an excellent discussion. "The Times" annual review of the iron and steel industries particularly mentioned the balanced blast cupola, in a tribute to the work of the British Cast Iron Research Association.

At a joint meeting of members of the Association and the London Branch of the Institute of British Foundrymen, Mr. N. L. Evans[13] gave a Paper on the use of soda ash in desulphurising cast iron, which provoked a lengthy and interesting discussion. Soda ash is now used in practically all sections of the industry where a reduction of sulphur is required.

Other Work.

Space does not permit reference to all Papers which have been published during the year. An outstanding feature has been the amount of work published by Mr. J. E. Hurst. Mr. S. E. Dawson[14] surveyed the application of recent research to foundry practice, with special reference to the use of rotary pulverised fuel furnaces and the changes which these have made possible. During the year these furnaces have made decided progress. The exchange Paper by Mr. Kain[15] to the Prague Conference dealt with the phenomenon of inverse chill, several possible explanations for which were put forward.

Melting Practice.

Jungbluth and Heller have considered blast volume and coke charge in cupolas in relation to output[16]. They find that the output of the cupola furnace is directly proportional to the volume of the blast, provided the charging door gases, CO and CO_2, maintain a definite ratio to each other. With an increase in the quantity of coke, however, and the same blast volume, the ratio of CO_2 and CO is upset because the amount of CO increases and the output falls. In a second paper[16] the same authors have discussed the calculation of blast volume from gas analyses.

Blaydon and Riley[17] have described an apparatus for determining the combustibility of coke, by which the minimum amount of air required to maintain a test sample of coke in a state of incandescence is determined. This test promises to be very useful in evaluating cokes.

Mechanical and Physical Properties.

In the early part of the year Mr. W. West[18] published a Paper on the influence of phosphorus, making it clear that phosphorus content, working under the conditions he was required to meet, gives rise to an extended solidification range, and hence to drawn and spongy places in castings of varying section. This work was extended in his French exchange Paper.

Several Papers have been published on wear, chiefly in the nature of reviews, particularly Wallichs and Gregor, Knittel, Heller[19]. All these, however, have been over-shadowed by the work carried out by the Research and Standardisation Committee of the Institution of Automobile Engineers[20], in which it is clearly demonstrated that a very big factor in abrasive wear of ordinary cylinder working under lubricated conditions is corrosion. One of the extraordinary results of this investigation was that practically everything which the average motorist tries to do with the object of diminishing wear, tends to increase it, whereas the conditions which tend to prevent wear, such as a hot engine, are those which the average motorist would consider promotes it. What apparently happens is that the combustion of fuel in the engine produces a certain amount of water vapour, together with organic and inorganic acids. On a cold cylinder wall this may condense and give rise to corrosion. The use of corrosion-resisting irons such as the austenitic irons referred to above definitely reduced corrosion, as did the use of fuels like hydrogen which do not yield acids on combustion. Experiments with austenitic irons are proceeding.

Dr. J. W. Donaldson[9] presented a useful contribution to the Iron and Steel Institute on thermal conductivity, which gives actual values and shows the variation of conductivity with carbon and silicon.

Mr. Hurst's Papers include a useful series of summaries of the influence of lesser known elements in cast iron, molybdenum, tungsten and titanium[21], and of vanadium and cobalt[22]; and of other still rarer additions[23]. In a Paper to the Iron and Steel Institute, the wear resistance of nitrogen-hardened cast iron was dealt with, showing that under both laboratory and road tests this type of iron stood up to between two and three times the mileage for the same wear, compared with other hardened and tempered centrifugally cast alloy irons[24]. Another series of articles[25] deals principally with the mechanical properties of cast iron, especially the elastic modulus. These Papers give a series of observations on irons submitted to a method of testing, the piston ring test, which is not only closely controlled by a B.S.I. Specification, but which is by its nature rather sensitive. Such observations would be greatly enhanced in their value if a means of interpreting them in terms of standard test bars were available.

Steel Castings.

Mr. C. H. Kain has published a useful Paper on defects in steel castings[26], and the year has also seen the publication of the first report of the Steel Castings Research Committee[27]. Dealing as it does mainly with defects in a few typical castings, made by different foundries, this has been criticised as giving buyers and users of steel castings an erroneous impression of the difficulties of manufacture, but the origin of the work and the circumstances which led up to it explain the lines followed. The report is valuable, but the wisdom of broadcast publication has been questioned.

Conclusion.

While the year has not witnessed any startling development, the above record shows that a great deal of useful work has been accomplished, a review of which may serve to direct attention to matters which, in the volume of current publication, might be overlooked. At the same time, a brief review such as this can lay no claim to being comprehensive.

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Railway Foundry Mechanisation.

(*Concluded from page* 48.)

shed. The empty moulding boxes are replaced on the conveyor, which carries them on to the machines, where they are picked off by the moulders as required. Referring back to the list of unproductive operations given above, it will be seen that the scheme has now resulted in a marked reduction in items 2, 3, 4, 7 and 8.

Sand Reconditioning.

The used sand falls through the grating of the knock-out grid, and feeds a horizontal apron-plate conveyor running some 8 ft. below floor level. On either side of this conveyor is a bin—one containing new sand and the other coal dust. These bins feed on the apron plate in a continuous trickle, and the mixture is deposited into the boot of No. 1 vertical elevator, shown at E, Fig. 7.

At the top of this elevator the sand passes over a magnetic screen, which rejects all metallic particles down a waste pipe. From this the sand passes over a vibratory riddle and thence to a large-capacity cooling hopper. The bottom of this hopper is sealed by an inclined belt, which, when in motion, conveys a stream of sand from the hopper and deposits it in a sand-rubbing machine, which thoroughly mixes the old and new sand, and where water is added as required.

The mixed sand gradually works to the edge of the table of this machine, whence it is scraped off into the foot of No. 2 vertical elevator (L, Fig. 7), which in turn deposits it on the disintegrator. This consists of a fast-running horizontal plate, on to which the sand falls and from which it is thrown by centrifugal action through a screen of nails, this finally breaking up and aerating it.

The treated sand is then conveyed by a plate conveyor over the tops of the moulding machines, and deposited in hoppers situated directly over each machine, so that each moulder has his supply of correctly-treated sand ready to drop into his moulding box by merely opening the hopper valve. Figs. 1 to 5 show the location of the plant with reference to the cupolas, core ovens, fettling shed, etc.

Amongst the problems that present themselves in establishing a mechanisation of this nature, the following may be mentioned as being among those needing the greatest consideration:—(1) The design of the bearings to ensure adequate lubrication and protection from the sand; (2) the design of runners so that feeding the casting is eliminated, and (3) the fixing of the best speed for the moulding conveyor, so that: (*a*) the highest speed is obtained consistent with the rate at which moulds can be made; (*b*) sufficient time is given between pouring and knocking out for the average size casting to set, and (*c*) core setting and pouring can be satisfactorily accomplished. Fig. 6 shows the types and weights of typical castings produced on this plant.

Mechanisation of Foundries.

By A. W. G. BAGSHAWE (Managing Director, Bagshawe & Company, Limited).

DURING the last year the number of new mechanical-handling installations in foundries has been smaller than might have been expected. The situation is not, however, as discouraging as it appears to be at first sight. Although only a few moulding shops have been equipped recently with sand- and mould-handling machinery, foundry managers and owners have been giving very serious consideration to the whole question.

It is now realised that if castings are to be produced at cheap prices, and of good quality, foundries need proper equipment just as much as machine and assembly departments. The writer has been pleased to observe that the directors and higher officials of large concerns are now expressing a desire for better foundries on their own initiative. This particularly applies in manufacturing concerns where the foundry is subsidiary to other departments. This state of affairs is a great improvement on the old-time conditions when the foundry manager had to fight for every bit of new equipment, however small.

Causes of Delayed Installation.

There has been a tendency to delay mechanisation until something more is known of the results in those foundries where such plant has already been installed. It can be safely said that we are now in this country reaching the end of the experimental stage, and it is generally recognised that, provided the work is suitable, a mechanical foundry can easily beat a competitor not so equipped, on both price and quality. It follows that all light foundries on repetition or semi-repetition work will, within the next few years, be compelled to instal mechanical equipment as an alternative to being driven out of business by more enterprising competitors. Progress in this direction has been undoubtedly slow in this country, and we are behind the Continental foundries and those of the United States. The first mechanical foundry installation was laid down in the United States over 40 years ago, and the same installation, with certain modifications, was running a few years ago, and is probably still being used. Shortage of liquid cash has been another serious cause for delay in the change over. Many of the responsible officials realise the great savings that can be effected, but they have difficulty at the present time in finding the necessary money to cover the first cost. It is a debatable point as to whether the foundry industry might not take advantage of those organisations which are willing to provide capital for new machinery of this kind.

Heavy Foundry Mechanisation.

So far, in the heavy foundries, very little machinery has been used with the exception of overhead cranes. It is interesting to note the increased popularity in recent years of light electric and pneumatic hoists. These handy and inexpensive machines can be of unlimited use to intelligent workmen. They avoid a lot of tiring work and undoubtedly help to reduce production costs.

Continuous conveyors for moulds are obviously useless in heavy foundries, but there seems to be no sound reason why, in due course, such foundries should not have machinery to prepare all the sand and deliver it properly mixed to the moulds. If it pays a light foundry on repetition work of low value to have the whole of the sand properly mixed and prepared, it is reasonable to suggest that a similar procedure can be adopted for heavy work where failures are very costly.

New Installations.

The foundries which have been "mechanised" during 1933 cover the production of castings varying from a few ounces in weight to 50 or 60 lbs. each. The electrical side of the engineering industry has led the way with several installations. These are particularly interesting, as the electrical trade calls for a high degree of surface finish.

The gas-stove manufacturers, who have been experimenting for some time, have placed orders for both sand and mould-handling plants. In addition, similar equipment has been put in by one or two general foundries not specially equipped for repetition work. It is rather early to give any indication as to the success of these new plants, as it takes some time to get the best results. There is every reason to believe that by this time next year most of them will have gone a long way towards paying for themselves.

Quality Improved.

The quality and finish of the work produced in the mechanical foundries has, without question, shown improvement. This can probably be attributed to some extent to more care in looking after moulding machines, boxes and patterns. Greater efficiency justifies a little additional expense in keeping the equipment in order. The same increased rate of production necessitates fewer moulding machines and boxes. Consequently a higher rate of depreciation can be allowed, giving earlier opportunities of replacing obsolete plant. The cost of introducing up-to-date moulding machines could be soon covered if the machines are used to their full capacity. Without a heavy increase in labour cost, this cannot be done unless there is a properly-designed system providing a continuous supply of sand and for the removal of completed moulds.

The developments for 1934 will depend greatly on the general state of trade, which, fortunately, seems to be improving. If this improvement continues, a well-designed mechanical installation in a foundry will allow for increased output without further building extension. Alternatively, foundry work can be concentrated, thereby releasing valuable floor space for other work. Where a completely new foundry is being put up on mechanical lines, a much smaller building can be used. The saving in cost on the smaller building would go far towards paying for the necessary labour-saving machinery.

No Excuse for Delay.

There is a certain feeling that it is advisable to wait until trade improves before spending much money on foundry improvement. This is undoubtedly wrong, as better efficiency and lower production costs can undoubtedly be obtained in a large number of existing foundries even on a reduced output with the help of proper machinery. If a definite appreciable saving can be made in the cost of production by installing new plant under existing conditions, there is no excuse for waiting for an increase in trade before making the improvement.

Before embarking on any mechanical system in a foundry, it must be fully recognised that such a place must be reserved for experts. Every man employed must be a specialist in his own particular job. This applies not only to moulding, but to sand preparation, pouring of iron, knocking out, core-making and inspection. If the organisation is not on these lines, the output will be below expectation, and a reasonable return on the invested capital will not be forthcoming. The plan of campaign must provide for, not only rapid production, but at the same time improved quality and finish as well as better working conditions. If in the future we want men to work in foundries, concentrated effort must be made to improve conditions and relieve men from unnecessary heavy work which can be better done by machinery such as conveyors.

Sand Preparation.

Sand-preparation machinery should now include cooling, milling or mixing, magnetic separation and aeration, apart from the addition of new sand and coal dust. In many cases storage is also necessary. A definite attempt has been made in some cases to eliminate the use of special facing sands, and there is certainly a possibility of more extensive use of synthetic sand in mechanised plants. The makers of sand-milling machinery are somewhat behind, as their machines are still unable to deal with large outputs without duplication.

Mould-handling machinery installed during the past year has been generally of the moving-platform type. In some cases, however, gravity roller conveyor tracks have been used for handling moulds where first cost is a consideration. The general introduction of gravity-roller conveyor in light-iron foundries would, in many cases, take a very short time to pay for itself, and would eliminate a lot of tiresome, unproductive work. The portable nature of this type of conveyor makes it very suitable for use in foundries where conditions and jobs are necessarily frequently changed.

A certain amount of information is now available on the cost of running mechanical plants. Sand preparation and distribution should not cost more than 5s. per hr. for an output of 30 tons of sand per hr. This figure covers a production of thoroughly-mixed prepared sand. Mould-handling conveyors, when power driven, usually do not take more than 4 or 5 h.p. per hr. The cost of repairs and maintenance should not exceed 5 per cent. on the first cost, and 10 to 12½ per cent. depreciation should be ample.

Melting Plant.

No drastic improvements have taken place in the methods of charging cupolas. In foundries using large furnaces, the drop-bottom type of charging hopper still appears to be most satisfactory. For small cupolas, the lift and stage still appear to give the best results, although a few skip hoists have been installed.

Core shops have been receiving considerable attention recently, as it is generally recognised that the coremaking equipment needs much improvement. A number of continuous-drying stoves have been ordered during the last year. There is every possibility that in the near future all coreshops, except those dealing with very large work, will need some type of continuous stove to ensure definitely-correct baking. Machinery for preparation and distribution of core sand is very similar to that used for moulding sand, but the smaller quantities usually do not justify a large capital outlay. The same applies to conveyors for handling green and baked cores.

Core Handling.

The use of conveyors, particularly those of the overhead type, for handling baked cores, now makes it practical to have the coreshop a considerable distance from the foundry if desired. The cost of transport over distances of even 1,000 ft. only amounts to a few pence an hour.

Some serious consideration is now being given

to the handling of castings in the fettling and finishing departments. After knocking out, any casting of a reasonable size can be more economically and easily cooled on a conveyor than in any other manner. In fettling and inspection departments, the platform type of conveyor can eliminate nearly all heavy manual work. Similar arrangements can be made for feeding sandblast and grinding machines. Gravity roller conveyor can also be used with considerable advantage for this work. Being inexpensive in first cost and very portable, this particular type of conveyor in many ways offers advantages over power-driven conveyors in the finishing departments of the foundry. A more robust design to withstand rough usage is now generally employed in place of the lighter types which did not give very satisfactory results in the past.

A New Type of Conveyor.

In one case at least, a new type of conveyor in this country has been introduced for handling spare molten iron left in the ladles and delivering it in the form of pigs to the charging platform for re-melting. This type of conveyor is equipped with special apparatus for cooling and coating the moulds with a composition to prevent the molten iron sticking to them. A machine of this kind is a great help in keeping the foundry floor clean and getting rid of those unsightly masses of surplus iron of unknown analysis which are frequently seen in many of our moulding shops.

Finally, the question of maintenance has begun to receive proper attention. In changing over to a mechanised system, it is obvious that many difficulties will arise. Some of these difficulties could be reasonably attributed to the machinery itself. In many cases the troubles have not been so much due to the quality or design of the machinery as to the way in which it has been looked after. Foundrymen using mechanical plant, and those who intend to use such plant, are strongly advised to treat it as they would a machine tool. Depending on the size of the installation, a competent man or men should be constantly employed on greasing, oiling and minor adjustments if the best results and the longest life of the installation are to be expected. The cost of such man or men should be regarded as a direct charge on the production costs. These men are as important a part of the organisation as any moulder or other workman employed in the scheme.

The Light Castings Industry in 1933.

By Capt. KENNARD, R.N. (Managing Director, Falkirk Iron Co.).

WHEN all thoughts and endeavours are concentrated on national recovery, it is a pleasant task to be able to report a very distinct improvement in this industry during the year 1933. A little investigation into the causes of this improvement may be interesting.

Price Maintenance.

A large proportion of the light-castings industry is engaged in the production of cast-iron rain-water and soil pipes and their appropriate fittings. 1932 proved to be a period of intense price cutting, particularly in this section of the trade. To such extremes had this gone that it became evident to every thinking person, whether manufacturer or distributor, that if this state of affairs was to continue disaster faced everyone engaged in this business.

Exports of Builders' Castings from the United Kingdom for the last Nine Years.

Year.	Tons.	£
1925	19,141	873,761
1926	19,668	882,118
1927	17,929	829,644
1928	19,682	876,745
1929	20,522	928,274
1930	17,852	796,865
1931	13,972	620,457
1932	10,536	442,894
1933	12,968	537,014

After considerable negotiation between the manufacturers and merchants, a price-maintenance scheme was adopted and came into force on May 1, 1933. It is only fair to say that this was made possible by concessions made by some with life-long antipathy to controlled prices, and for this assistance the trade in general should be grateful. There was also adamant opposition to the scheme in a certain direction. The merchants, however, decided to brave this obstacle—a wise decision.

To administer this price-maintenance scheme a Joint Standing Committee was appointed consisting of equal representation from the Merchants' Organisations and the British Ironfounders' Association. The writer has the honour at the moment to be chairman of this body.

Housing Programme and Confidence.

The revival in this industry, of course, cannot be attributed to merely the formation of an association. The Government's intentions in regard to the clearance of slum properties and the re-housing of the people in decent conditions is too well known to require further mention. In addition, the building of houses to sell or let is becoming an economic proposition, with the reductions in costs and particularly in the lower cost of money. Another factor in the improved position can be described as "confidence." When price cutting is the vogue, stock is a speculative asset; one day it can be valued at so much, to-morrow at something far less, just at the whim of some ruthless competition. With stabilised prices it is a different matter; a stockist has confidence in his position, confidence is restored to the trade to the benefit of all, and this in itself goes towards increased demand.

CAPT. KENNARD, R.N.

Undoubtedly the right moment was selected to launch this arrangement, and it would be a thousand pities if anything were allowed to nullify all the work that has been expended on the building up of this organisation.

Baths and Other Castings.

Concurrent with the demand for pipes, a similar demand for baths is apparent. It is probably no exaggeration to say that no bath maker in this country is level with his order-book. As with the rain-water and soil goods, the bath merchants and manufacturers have taken steps to meet the situation. In order to make a satisfactory arrangement, the importers' interests had to be considered; this has been satisfactorily arranged, and the International Bath Association is now in being, the adherents to which are the British Bath Manufacturers' Association and the Gussemaille Syndikat G.m.b.H. and the British Merchants' Associations.

There are "many other things" manufactured by the light-castings industry besides baths and pipes; these products mostly come under the headings of "Fitted Goods" and "General Castings." The demand for these goods is almost relatively as strong as the above mentioned.

Exports of Cast Pipes and Fittings from the United Kingdom for the last Nine Years.

Year.	Tons.	£
1925	94,251	1,348,900
1926	86,984	1,148,758
1927	122,823	1,495,251
1928	114,189	1,321,662
1929	136,107	1,455,202
1930	116,305	1,294,041
1931	72,776	804,930
1932	65,635	671,439
1933	86,327	834,153

But the British are a funny people; "sturdy independence," "survival of the fittest," "down the *effete*" (provided it's not me) are our watchwords. It must be the legacy of some combatant spirit, probably from the Highlands, if one can judge from the direction of most of the opposition.

Surely, if agreement can be attained and undoubted benefits derived in one section of the light-castings industry, it should be possible to do likewise in this other section. So much for the commercial issue.

Progress.

A notable advance in this industry occurred during the period under review, when an improvement to rain-water and soil pipes in the "Melt-on" type of ear was produced. The inventor was Mr. Melton, of Warrington, the details of whose invention will appear in a future issue, and which should be studied with great interest. The manufacturing rights of the "Melt-on" ear have been acquired by the British Ironfounders' Association, and the production consequently limited to their members.

The formation of a strong Bath Association is also likely to influence an improvement in the designs available to the public. When price-cutting holds sway, little attention can be given to research. It is pleasant to be able to draw such attention to the benefit of co-operation.

The prospects for this industry in 1934 undoubtedly as far as demand is concerned, should be increasingly favourable. There is still obviously a great deal to be done by way of organisation if the full benefits of improvement in trade are to be harvested.

The Non-Ferrous Foundry in 1933.

By A. J. MURPHY, M.Sc. (Chief Metallurgist, J. Stone & Company, Limited).

AS far as it is possible to divorce the economic from the technical aspects of foundry production, there is little doubt that it is the former which has commanded the greater part of the foundry executive's attention during 1933. In the metallurgical field, however, the action and reaction between commercial considerations and technical limitations and developments are now so inevitable that each must take into early account the implications of changes in the other. There is reason to believe that the time lag between the working out of ideas in the research laboratory and their industrial application is gradually being reduced. Evidence to this effect is provided by the fact that, while in the year 1932 and the earlier part of 1933 the foundry industry might have been thought to be entirely pre-occupied with questions of immediate economies, the very welcome improvement in business during the later months of 1933 has revealed the considerable advances in foundry reorganisation and technical efficiency which were being effected unobtrusively in the period of most acute depression.

A general realisation of the vital necessity for maximum efficiency in all foundry operations has been responsible for numerous critical inquiries into the subjects of mechanisation, choice of melting fuels and furnaces, and methods of heat-treatment.

It appears to be generally accepted that in the great majority of British non-ferrous foundries the variety of the work handled precludes the complete mechanisation which has been applied so successfully in the most modern ironfoundries. The precisely-timed continuous conveyor seen in the latter can hardly be contemplated, for example, in the normal brass and bronze foundry, where half a dozen different alloys may be in demand for moulds simultaneously or in rapid succession. Nevertheless, within these limitations, peculiar to the non-ferrous foundry, several well-thought-out schemes of partial mechanisation have been put into operation, with the main objects of ensuring a steady supply of conditioned sand to moulding machines and of accelerating the movement of moulds from the machine to the casting floor. In some respects it may be said that the planning of such partial mechanisation requires more thought and careful judgment than some of the much more impressive fully-mechanised systems.

Melting Practice.

For metal melting in the general non-ferrous foundry the practical choice still remains confined to coke, oil and gas. Electric melting by low-frequency induction has strengthened its position for special cases where continuous working is possible, as in the casting of brass billets for rolling or extrusion, while at present the high-frequency electric furnace and the arc furnace can only justify their high capital cost in application to alloys of high-melting point, such as those of nickel and chromium. Electric-resistance furnaces, which on many technical grounds would be so desirable for melting aluminium alloys, have not overcome to any appreciable extent the disadvantage of heavy running expenses, which arise, of course, from the cost of electric power. Controversy will continue for a long time regarding the comparative merits of coke, oil and gas for crucible melting. The issue will be largely affected by local conditions, but it would certainly appear that in general the past year has seen coke and gas on the defensive, the progress of oil melting not being retarded nearly as much as was anticipated by the duty of 1d. per gallon imposed on fuel oil. In the non-crucible open-flame furnaces, as applied to brass and bronze, oil has had the field to itself, at least in capacities below 2 tons; for larger reverberatory furnaces no serious inroad on coal as a fuel has been made. So far as the writer is aware, pulverised coal has found no application to non-ferrous metal melting in this country.

Non-ferrous foundries are concerned with heat-treatment almost exclusively in connection with aluminium alloys. In this direction the new equipment installed in 1933 has been mainly of the electric-resistance furnace type, with forced-air circulation. One ingenious new departure introduced during the year employs low-frequency heating, temperature control being effected by a range of ferrous-core

MR. A. J. MURPHY, M.Sc.

materials having different magnetic critical points. Metallurgically, the method is attractive, because it depends for its operation on an internal standard governed only by the choice of core alloy. It is too early to form an opinion as to its success in industrial application.

High-Tensile Alloys.

While it can hardly be said that 1933 has produced any revolutionary development in the way of new alloys, steady improvement has been made in the improvement of existing materials. Among brasses and bronzes, mechanical properties have been pushed up still further, so that, for example, a manganese bronze is now available which gives, in sand castings, a tensile strength of 50 tons per sq. in., with an elongation on 2 in. of 15 to 20 per cent. Similar developments in aluminium bronzes have resulted in a tensile strength in sand castings of 45 tons per sq. in., with a fatigue limit of ± 15 tons per sq. in. on a basis of 20 million reversals. Beryllium bronze, which has given such phenomenal mechanical properties in the forged condition, has so far been disappointing in sand castings. Whereas over two years ago heat-treated forgings of the 2.5 per cent. beryllium copper alloy had given a tensile strength of 90 tons per sq. in., the best result obtained in heat-treated sand castings was reported earlier in the year as 50 to 55 tons per sq. in., and this was accompanied by an elongation of only 1 or 2 per cent. The difficulty encountered here may be connected with the slow rate of solution of the copper-beryllium compound to form the α-solid solution in the first stage of heat-treatment in sand castings. Considerable investigation is in progress, however, on these alloys, and it is possible that ultimately a way may be found of overcoming this obstacle.

While dealing with aluminium bronzes, it is satisfactory to record an increased appreciation of their possibilities in the form of die castings. The high strength obtainable has permitted aluminium-bronze die castings to replace steel forgings in many instances, with substantial economies in machining costs and advantages in resistance to corrosion.

Nickel Alloys.

In relation to nickel alloys, the Information Bureau of Nickel Manufacturers has continued its extraordinarily effective service. One result of this has been the increased interest in castings of Monel and silicon-Monel metal. Increased experience gained in the melting and casting of these alloys has widened the scope, both as regards size and intricacy of castings, of the work which can now be undertaken.

Attention has been called recently to the effect of heat-treatment on modified aluminium-silicon alloys to which small additions of magnesium and manganese have been made. The improvement in yield point and tensile strength thus obtained may prove to be of importance in applications where the reduced ductility, as compared with "straight" aluminium-silicon alloys, can be tolerated. The troublesome effects of gas in aluminium alloys have continued to receive attention, and the opinion has grown stronger that the only satisfactory solution is to be found in obtaining virgin metal free from gas, and maintaining it gas-free throughout the melting and casting operations. Until the suppliers can provide consistently gas-free metal, however, the founder has to make the best use of existing methods of degasification. De-gassing processes which have been employed during the year are pre-solidification, and to a lesser extent the nitrogen, nitrogen plus chlorine and nitrogen plus volatile chloride methods. The claims for various fluxes as degassing agents have hardly been borne out in practice, the reason possibly being that a flux which will weaken the oxide film to allow gas to pass out from the surface of the molten metal is fairly certain to permit equally easy ingress of harmful gases from products of combustion.

The most important change during 1933 in the specifications which concern the foundryman is the adoption of the sand-cast test-bar as standard for aluminium-alloy castings by the British Standards Institution. It is, perhaps, too early to ascertain to what extent the new procedure is working in foundries generally, but it would not be expected to cause any difficulty in reference to sand castings. It will be interesting to see whether any complications arise in the application of the sand-cast test-bar to die-casting work.

There is little to be reported in a survey of this character on the subject of bearing metals during 1933, in so far as foundry work is affected. In the majority of instances the tin-base white metals have maintained their position for import duties, in spite of the increased price of tin. In the specialised field of aero engines and the new light-weight diesel engines, lead-bronze bearings have aroused considerable interest, but they scarcely fall within the activities of the general non-ferrous foundry.

(*Concluded on page* 54.)

XUM

The American Foundry Industry in 1933.

By DAN AVEY (President-Designate, American Foundrymen's Association; Editor, "The Foundry").

THE major portion of 1933, so far as the foundry industry in the United States is concerned, was devoted to regimenting the industry for operation under the National Industrial Recovery Act signed by the President on June 16. In common with many other industries, the four main divisions of the foundry industry—steel, malleable, grey iron and non-ferrous—have built in 1933 the foundation for recovery and advancement. Six months of the year have served to consolidate the four branches of castings manufacture under codes designed to fit the requirements of the National Industrial Recovery Act. This activity, which has required more than ordinary effort on the part of leading foundry executives, has resulted in a consolidation of interests, an intensification of co-operative effort, and has provided the machinery for better business and merchandising practices.

In addition to the four main process classifications previously enumerated, the foundry industry is a major component part in the broader industrial set-up under the manufacture of various types of machinery, such as the automotive, electrical, railway, etc. Here the departmental foundries are mainly responsible to the codes governing the owner establishments. Furthermore, such specialties as radiators, pipe, soil-pipe and cast-iron boilers have separate codes.

As a measure of comparison with conditions abroad, it may be interesting to note that the average hours-per-week operation permitted range from 36 to 40 hrs., with a few exceptions to take care of such inelastic conditions as may arise in special cases. The rate of pay guaranteed to the lowest labour classification, designated as common labour, ranges from 27 cents (1s. 1½d.) per hr. in the south to a fairly uniform average of 40 cents (1s. 8d.) per hr. in the north.

In the jobbing-foundry classifications, manufacturers have taken advantage of this law to write in rules tending to alleviate certain abuses in trade and merchandising practices. The consideration of prices, forbidden under the structure of anti-trust laws unless specifically abated by Presidential decree, still hampers any sort of agreement as to raising prices. However, one slight advantage has been gained through permitting a so-called open-price arrangement by which each foundry may file with its code authority a list of prices upon various classes of specialty types of castings, and no foundry filing such a price list may cut this price without filing a notice of such intention with an interval of ten days before reduction may be made. This condition may be difficult to understand when such broad powers as to price regulation are permitted to European foundries in general.

The Forthcoming International Congress.

The American Foundrymen's Association has continued and expanded its furtherance of advancement in technical and metallurgical lines. As the British know from their acquaintance with the A.F.A. management, improvement in production methods results from advancement in technical practices through the Association's efforts in providing stimulating Papers, discussions and instruction in the sciences, arts and crafts of castings manufacture. The Association encourages and sponsors active research to improve materials, processes and methods. It stimulates exchange of knowledge and centres attention on new developments through holding periodic meetings comprising technical sessions, round-table conferences and shop-instruction courses. Intimate acquaintance with new materials and equipment is offered through exhibitions, displays and demonstrations arranged concurrently with these conventions. It prints, publishes and distributes formal Papers and resulting discussions relating to technical and Association affairs. In all activities relating to advancement in various phases of the foundry industry the Association acts without favour or prejudice as an impartial agency for the dissemination of information.

The work of the American Foundrymen's Association, in co-operation with the Institute of British Foundrymen and other overseas foundry organisations, is too well known to need individual comment. However, it seems appropriate on this occasion to call attention to the forthcoming Fourth International World Congress of Foundrymen to be held in Philadelphia from October 22 to 26. Extensive plans are being made for an outstanding programme of technical Papers in which it is hoped that our European friends will co-operate in the usual splendid fashion. In addition, it is hoped that 1934 will bring before the foundry world one of the largest and most complete displays of foundry materials and equipment that has been possible for many years.

MR. DAN AVEY.

Technical Developments.

Despite the great amount of attention which foundry owners and executives have been obliged to devote to business and management problems and to their organisations under the President's recovery programme, progress has not been lacking in the development of foundry technical and operation procedure.

In metallurgical practice a marked trend towards the increasing use of alloys in both steel and grey-iron practice is apparent. The latter found expression through a symposium presented under the joint sponsorship of the American Foundrymen's Association and the American Society for Testing Materials in Chicago during June. A better knowledge and understanding of new qualities and higher physical properties attainable in grey iron is set forth. The acceptance of these qualities in some measure has been responsible for broadened use as typified in automotive brake drums, camshaft and crankshaft production in grey-iron castings. Some investigation on nitriding grey iron is under way. In malleable castings, much attention has been devoted to the factor of wear resistance. The addition of chrome to malleable is a new development.

In foundry practice, the necessity for limitation of output due to low demand for castings has led to the development of small units of different classes of machinery and equipment. Considerable attention has been devoted to small cupolas. A broadened use of high-frequency induction furnaces in steel foundries, particularly for the production of high alloys, was an important development of 1933. Several larger-type furnaces employing powdered coal have been under practical investigation in grey-iron shops The application of recuperators and preheating devices to both cupolas and air furnaces indicates some wider application of this practice. Heat conservation is an important factor in melting practice. The introduction of heat insulated and covered ladles in one large malleable foundry has been followed by a number of installations in grey iron, malleable and steel foundries.

Although the low rate of operation has not been conducive to development of high production methods, some advance has been made in permanent-mould casting practice. A notable advance in the aluminium field has been the increase in size of castings which can be produced from permanent moulds. Permanent-mould grey-iron castings also have had more attention, and with increasing demand the application of this practice probably will be extended.

Improvements in foundry equipment, perfecting of existing machines and a few entirely new developments have resulted in 1933. A wider application of the use of pneumatic pressure for blowing large cores and moulds, the introduction of an entirely new device for utilising metallic abrasives delivered at high velocity by centrifugal force, and the commercial application of hydraulic cleaning methods to castings are significant of trends.

The Non-Ferrous Foundry in 1933.

(*Concluded from page 53*)

Taking a broad view of the non-ferrous foundry industry as a whole, there can be no doubt that the year has closed with a brighter outlook than has been seen for many months past, and with enough solid achievement to its credit to justify a considerable measure of confidence. This review cannot close more appropriately than with a quotation from a speech by Lord Melchett at the annual meeting of the British Cast Iron Research Association in November: "I do not think Great Britain has had such an opportunity for industrial progress and expansion, since perhaps 1900, as it has at the present time. Our competitors are in nothing like such a relatively strong position as they were four or five years ago, and we, with an increasing stability, have a chance of making progress and of outstripping those who would compete with us in the world's markets, such as we have not had for many years past, or are likely to have in the future if our competitors are given the opportunity of again catching us up. Now is our chance and our opportunity, and it is to be hoped that we will take it."

Czecho-Slovakian Foundry Industry in 1933.

By Prof. Dr. MONT. FRANT PISEK.

THE past year was outstanding for Czecho-Slovakian foundrymen. The International Congress of Foundrymen, held in Prague, gave them the opportunity to welcome representatives of the foundry industry of fifteen countries, to show them their works and the arrangement and management of their plants, as well as demonstrate the goodwill for international collaboration which is so very necessary to lead the world out of its present crisis. Due to this crisis it was not possible to receive the guests in a manner which would have been possible in more normal conditions, but the result of the Congress and the general satisfaction shown were sufficient stimulus for future effective international collaboration by Czecho-Slovakian foundrymen.

At the beginning of last year Czecho-Slovakian industry had undergone a serious crisis, previously unknown. Industrial production, which was getting worse and worse in comparison with the year 1932, had a slight amelioration, which proved to be only transitory, before the Congress. Employment in the grey-iron foundries was in 1932 about 40 per cent. of that of 1929, but it fell last year to between 30 and 35 per cent. The same was shown in the steel, malleable, brass and aluminium foundries, where it diminished by 10 per cent. towards 1932.

In addition to the general world situation, there were other reasons for a further diminution in production. These were above everything else the price of pig-iron, which in Czecho-Slovakia is much above the level of the international market, and very dear bank credits, consequent upon lack of money. Another important factor was the new laws regulating motor-transport taxes, which made such transport infinitely dearer, because it insisted upon motor cars using a mixture of petrol and alcohol (20 per cent. alcohol, 80 per cent. of petrol). This law has greatly impeded the production of automobiles, not only that of passenger cars but also of lorries, which obviously had a profound and detrimental influence on the foundries engaged in their production.

PROF. DR. MONT. FRANT PISEK.

Pipe Founding.

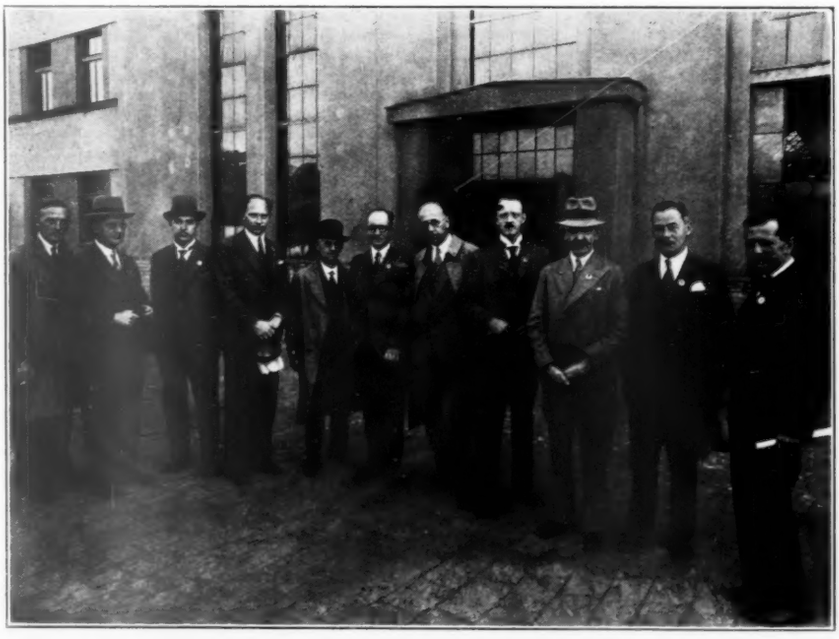
Foundries producing cast-iron pipes were very short of orders, due to the difficult financial position of the municipalities, in consequence of which no, or very little, building has been done. This fact was also felt in the foundries producing iron stoves. The consequence of the lack of money and orders was that less money was attracted to the foundry industry. Money was attracted only where an immediate return was to be expected from economies to be realised on fuel, cheaper metal mixtures, and so forth.

Particularly difficult was the position of those foundries which had tied up considerable capital in equipping their plants with the most modern machinery with the view to increasing production, as this could now be employed to a very limited extent.

Price Cutting Spoiling Business.

The main effort of the foundries has been to reduce their expenses and to reorganise their internal conditions. These factors have resulted in a reduction in the number of both workmen and staff employed. The continuation of intense competition and the desire to obtain orders at any price are to be seen in the low quotations some foundries make in their bids. These make a really critical situation still worse. Moreover, some foundries have created new departments for manufacturing new lines of castings, which renders the sale of various products still more difficult. This refers chiefly to the manufacturing of radiators, for which no less than eight plants have now special departments operating.

On the other hand, these conditions are now forcing new arrangements which, as we hope, will be realised in the course of the New Year. It is to be desired above everything else that the general economic situation will improve, for only this can bring about a real amelioration of the dire conditions now existing in the Czecho-Slovakian foundry industry. It is generally hoped that this year will be better for industry, and particularly for the foundry industry.



THE BRITISH GROUP AT THE 1933 (PRAGUE) CONVENTION.

The French Foundry Industry.

(*Concluded from page* 46.)

are witnessing an absolute price debacle (which we cannot control)—neither the profit nor the return on capital in all its forms ("working" capital and "financial" capital)—and everybody loses, every day, a little of his substance without any profit other than that superficial and momentary one which the consumer obtains.

It would take too long to give in detail the organisation of production as the writer would plan it. The formulæ, moreover, are legion, but all entail, as was said in the beginning of this article, the partial renunciation by everybody in the same type of industry of his absolute freedom to produce without any consideration of the needs of consumption.

To restore prosperity we must act upon a new policy which can be crystallised in two words—*organisation* and *discipline*.

New Year Gifts Received.

(*Concluded from page* 45.)

technical data, a week to the page; JOHN G. STEIN & COMPANY, LIMITED, leather-bound pocket diary, containing much useful data about refractories, four days to a page, with money rulings; BRITISH & CONTINENTAL TRADERS, LIMITED, leather-bound pocket diary, containing useful foundry data; STAVELEY COAL & IRON COMPANY, LIMITED, combination pocket case and diary, containing useful technical data and various measures, carried out in grey leather; HENRY WIGGIN & COMPANY, LIMITED, waistcoat-pocket combination money wallet and diary in blue leather, carrying four days to the page; J. STONE & COMPANY, LIMITED, a waistcoat-pocket diary.

XUM

The German Foundry Industry in 1933.

By Th. GEILENKIRCHEN, Dr.-Ing. (Director, German Foundry Employers' Federation).

A REPORT on any branch of German industry in 1933 must take account of the governmental changes which then took place. Since the advent of Herr Hitler, industry as a whole has shown a slow but continuous improvement, and has stood wholeheartedly by the new Chancellor's policy.

The relief or eradication of unemployment was the first and most serious problem, and this has been accomplished to the extent of a reduction of over two millions in the number of the unemployed since the *régime* began. This has been effected by many more or less correlated measures. Public works on a large scale have been instituted, such as the construction of great automobile roads in all parts of the Reich, the reconstruction of the State railway system, and the execution of urgently-required provincial and municipal works. In all these measures two factors have been kept in view: a reduction in unemployment and a revival in industry through an increased demand for supplies. In the financing of such measures it has always been sought to avoid placing an undue burden on industry itself.

Subsidiary, but by no means unimportant, measures have been the abolition of the automobile tax on new vehicles, which led to considerably increased activity in that industry; freedom from taxation for all new plant installed by undertakings to replace old plant up to the end of 1934, a measure designed to stimulate the engineering industry generally; taxation or other relief to house owners to encourage the reconditioning of dwelling houses on a large scale, and relief to agriculturists, with the twofold object of safeguarding the country's food supply and encouraging both the purchase and the production of machinery for more intensive cultivation. Finally, the new Government's scheme of marriage bounties or loans, instituted mainly for the purpose of taking women out of the labour market, had, it is believed, created 100,000 places for men by the end of the year and put 100 million marks into the furnishing and domestic-utensil industries. The visible financial result of all these measures is to be seen in the increased figures of the turnover tax. This brought in during the budget year 1932-33 (April to April) 1,350,000,000 Rmk., while from April to October, 1933, the return, notwithstanding various concessions, was 750,000,000 Rmk., or 1,500,000,000 Rmk. for the whole year.

Light Castings Industry.

If we now consider how the new *régime* has affected the foundry industry, it will be obvious that it could hardly fail to give a considerable impetus to the activities of foundries working for the engineering and building trades. This applies principally to works producing pipes, which have been well or fully occupied as a result of the resumption in the laying down of gas and water systems. The makers of rain-water goods of all kinds have also been actively employed. General building castings proper were less affected, as the new building activity had not increased appreciably during the period under survey. The reconditioning of the older dwelling houses, which was prosecuted on a large scale, had, however, a beneficial effect on foundries producing the castings required for such work. As many dwellings have been converted for central heating, the producers of boilers and radiators principally benefited, many of them being busier than ever before. Foundries turning out sanitary castings, such as baths, etc., had also a considerable amount of work as a result of this housing development. The demand for domestic utensils owing to the marriage bonus scheme was observable in the increased output of ovens, grates and cooking utensils.

Engineers' Castings.

While there has been increased activity in trade and building castings, the same cannot be said of machinery castings except as regards specially-favoured industries, such as the automobile trade. In many places, while foundries making motor-car cylinders had to work overtime in this department during the year, their other departments were either working short time or were closed down. The engineering trade still suffers from a lack of foreign orders, and the home demand, although increasing somewhat, is still far from making this deficit good; and, although many orders which would otherwise have been kept back have been given as a result of the taxation relief for replacement plant, even this has not sufficed to give the engineering works sufficient employment to enable them to pass large orders to the foundries.

In the case of many users of machinery who have been fairly adequately employed, *e.g.*, in the textile industry, the adjustment of their plant at great expenditure during the boom years to large capacity, which will probably never again be fully utilised, is now exacting its penalty, with the result that smaller normal outputs are gradually being provided for. The natural consequence is that a fair proportion of the existing machines have become superfluous, and, although such firms are gradually wearing out the machines corresponding to their decreased production, they still have so many spares that they will not decide to obtain new machines, even although, owing to the fiscal concessions, these have become cheaper than they will probably ever be again. For the present, the engineering works and the foundries must just resign themselves to this state of affairs.

In these circumstances it is obvious that the ironfoundries should be endeavouring in every direction to secure new markets for their castings and to recover those they may have lost. Thus much more propaganda is now being published to encourage the use of cast iron, its special suitability for many purposes, the knowledge of which has in some respects been lost by users, being set forth. It is already gratifying to note that the wave of enthusiasm for welded in place of cast parts, which has of late years been apparent to the detriment of cast-iron practice, is gradually beginning to subside, many consumers having recognised that in many machines they will not sacrifice the fatigue-resisting and other advantageous properties of cast iron.

Price Cutting.

During the past few years, as has already been repeatedly emphasised by the author in these columns, the prices ruling for castings have been inadequate, and under the conditions above described it has naturally been impossible as yet for them to improve. All that the foundries have been able to do of late has been to adjust themselves to the low prices obtainable and endeavour, by all possible technical and economic means, to bring their costs of production into relation with them, so as to reduce their losses to supportable limits. But, notwithstanding all their efforts to keep down costs, the pressure of consumers on prices was constantly renewed; there were always foundries prepared to accept orders at still lower prices, thus compelling former suppliers to accept such prices if they did not wish to lose their customers. Thus the price level for castings has been constantly depressed further, and even the well-meant warnings of the Association of German Foundrymen have not availed to arrest the evil.

Under the new *régime* the prospects of an improvement in this respect have considerably increased. The Government's attitude has been expressed in many proclamations: it means to secure for every trade and every occupation a fair price for fair work; on the one hand it will not tolerate anything in the nature of excessive prices, but on the other it will not allow entire branches of industry to be ruined by the cut-throat offers of individuals. In accordance with the generally accepted motto "The common interest comes before self-interest" the interests of the different vocational groups must be represented by these bodies as a whole. On the lines of this development the entire public life of the country must be established. This attitude of the Government has not, of course, sufficed to secure adequate prices for the foundry industry at one stroke. It has naturally contributed, however, to remove those obstacles to a general regulation of prices on the basis of a modest working profit, which the selfish attitude of many foundries has hitherto created.

In these circumstances the Association of German Foundrymen has been able to renew its labours, begun some years ago, for the purpose of binding the members to observe a minimum price-list based upon a reasonable costing system, and this with a greater prospect of success. At its last general meeting in Potsdam in September, 1933, the Association altered its organisation by merging its former 17 district groups into four great economic territories—west, central, east and south. These four economic territories will maintain their own business offices in Düsseldorf, Cassel, Berlin and Stuttgart, the head office being in Düsseldorf. In these four territorial offices the work of drawing up minimum price-lists according to a uniform scheme, but, taking special economic conditions into consideration, has now been begun. These lists will then govern the sale of all castings and will be gradually developed further. This work is now approaching completion, and it is hoped that the price-lists may be submitted for approval to an extraordinary general meeting about the end of January. The directors of the Association fully realise that much hard work remains to be done before their scheme can be completed. But they, together with the foundry industry as a whole, which has followed the progress of this work with the keenest attention, confidently trust that, under the new governmental system and by turning to account the forthcoming price-regulation agreements, the year 1934 will bring not only better employment but also such reasonable prices as will serve to crown their arduous labour with economic success.

At Bucharest negotiations have been proceeding for some time regarding a merging of the principal Rumanian iron and steel works, viz., the Reschitza Company, the Titan-Nadrag-Calan Company and the Copsa-Mica-Cujir metallurgical works. The Rumanian Government has assisted in the negotiations, which have led to a draft agreement, the main agreement to be concluded this month. The Government has promised the new trust large orders, the Reschitza works contracts for bridges and railway locomotives and the other works contracts for rifles, ammunition and other war materials, which were formerly purchased abroad.

The Non-Ferrous Metals in 1933.

(By Our Metal Exchange Correspondent.)

THE year just closed will probably be reckoned as the most satisfactory period since the slump in non-ferrous metals set in, for, although in the early months optimism was not much in evidence, and the breakdown of the Economic Conference made the outlook appear very black for a time, there was in the last quarter of the year evidence of returning confidence and a rise in the volume of trade. The year has been one of serious political and economic difficulty and uncertainty, and although it would be wrong to say that these troubles are at an end, it does appear that the horizon has cleared to some extent. In Europe tension has relaxed, and while some months ago the threat of war was being seriously discussed, a calmer spirit now prevails and sanity is returning. So much the better for the chances of trade recovery!

Perhaps the outstanding event of the past year was the drastic action taken by America in deliberately abandoning the gold standard in order to achieve a rise in commodity prices through depreciation of the dollar. This has meant that since April last the sterling dollar exchange has been in a chaotic state, the quotation going out at one time practically to 5½ dollars to the £. Abandonment of the gold standard by America has naturally constituted a serious threat to the position of those European countries still on gold, and during the latter months of 1933 the French exchange exhibited marked weakness. Altogether the non-ferrous metals have had a good deal to contend with, and on the whole they have acquitted themselves not too badly. A measure of restriction on output has been in force in all the metals throughout the year, and this looks like being continued during 1934, for all producers seem to have realised that consumption is still very much in the convalescent stage.

Copper's Poor Opening.

The opening months of 1933 found copper still engulfed in the trough of pessimism, which endured throughout 1932, and was responsible for the record low level of £28 for electrolytic wire bars set up in July of that year. The position was certainly not a happy one, for Copper Exporters, Inc., had broken up, the 20 per cent. curtailment agreement had automatically lapsed, and fears were expressed on every side that production, especially at the low-cost mines, would be considerably expanded. Rumours of a price war were current, and the expectation seemed not ill-founded, in view of the absence of demand. In consequence, it is not surprising that the opening quotations of £28 17s. 6d. to £29 5s. for standard and £35 for electro, although admittedly very low, were not maintained. In the United States the quotation was about 5.15 cents, and the price c.i.f. European ports stood at 5.20 cents, but within three weeks the c.i.f. quotation in cents was down to 4.95, standard had lost 10s. and electro 30s. At this time the exchange stood at $3.35.

The decline in copper values continued, although not so rapidly, until early in March, when the London market turned at £27 5s. to £27 10s. for standard and £31 15s. for electro, these prices proving to be the lowest point touched during the year. At this time the banking crisis was developing in New York, but, nevertheless, a recovery in values took place, electro reaching £34 5s. in mid March, while about a month later the quotation stood at £35, the dollar rate being $3.41 and the American export price 5.40 cents per lb. Business was rather slow and much uncertainty was in evidence owing to events in the United States and in Europe also.

On April 20 came the bombshell of America's abandonment of the gold standard, as a result of which the exchange weakened immediately to $3.88, the copper market keeping fairly steady at £29 16s. 3d. to £30 for standard and £34 for electro. The export price came over from the States at 5.80 cents. This, of course, marked the beginning of an upward movement in commodity prices generally in the U.S.A., while on this side the sterling quotation, instead of falling as the dollar weakened, rose rapidly in sympathy with the "bullish sentiment" across the Atlantic. This movement came to a head early in June, when standard was quoted at £38 11s. 3d. to £38 16s. 3d. and electro at £44 5s., the export price in America being 7.95 cents c.i.f. and the exchange about $4.01. The reaction which followed was fairly sharp, and sufficed to drop prices by a full £3 in a fortnight, but the report of improving conditions in the States, where consumption was running at some 45,000 tons per month against production at barely half that rate, brought "bulls" into the London market again and electro was back at £43 by mid July. At the same time the quotation on the domestic market in New York rose to 9.15 cents, with talk of 10 cents, or even 12 cents, before the end of the year.

Reaction in America.

There followed a brief period with the Custom smelter's quotation at 9 cents c.i.f. European port, but before long the exchange began to move against America, and on this occasion it did not bring with it a further rise in commodity prices. The first stage of President Roosevelt's prosperity drive had been accomplished, and the American public, forgetting what had been accomplished in four short months, began to pour cold water on the N.R.A. and all its activities. The seasonal summer decline in trade dragged on and the autumn revival lagged behind, although the sterling values of copper did not fall away unduly, owing to the fact that the American quotation kept very steady. This uncertain price trend persisted throughout September, with occasional recoveries as optimistic reports in regard to the copper code came into circulation, but towards the end of October the Customs smelters made a sudden and drastic cut to 8 cents in the hope of attracting business. The c.i.f. quotation came down to about 7.70 cents and prices in London slumped badly, the fall being accentuated by heavy selling of standard copper as a hedge against holdings, by producers and consumers. The weakness persisted until the middle of November, when, with the exchange listed at $5.46, the market went to £28 16s. 3d. for standard and £32 10s. for electro. This decline proved, however, to have been overdone, and quite a sharp recovery took place, but it was not until close on Christmas that persistent reports that the code would be adopted in the New Year brought a heavy inrush of buying orders which carried standard up to £33 10s. and electro to £37 5s.

There can be no doubt that the situation in copper is now very much healthier than it was at the beginning of last year, and with the realisation that, apart from electro, there is not any too much copper about, consumers, who have been playing a waiting game for so long, have made up their minds to increase their holding. This they feel can be done with reasonable safety, for, in face of the fact that trade both in this country and in America is improving, copper is undoubtedly standing at a low level.

Steady Progress in Tin.

The history of tin during 1933 was one of almost unbroken progress, while from the end of April onwards the advance was very rapid. The year opened with the price at £148, and during the first quarter values advanced very little beyond £150, but with the beginning of inflation in the United States in April the quotation climbed up rapidly to £160, and on May 1 stood at £171 5s. About three weeks later it passed £190, and on the last day of the month jumped nearly £10 to £210 10s., with a further rise to £227 10s. by June 9. Since that date the market has had its ups and downs, but closed at not much below £230 at the year-end. Statistically, the position has improved very much since January 1, 1933, and the following details are appended to show how the total visible supplies have come down to a satisfactory level:—Total visible supplies on January 1, 55,450 tons (price £149); March 31, 51,500 tons (£151 2s. 6d.); June 30, 46,200 tons (£221 10s.); September 30, 34,330 tons (£219 12s. 6d.); November 30, 29,100 tons (£225 12s. 6d.).

During the past year a very marked reduction took place in stocks of tin in this country, and it is interesting to compare the tonnage in warehouse at November 30, *viz.*, 10,532, with 30,370 tons twelve months earlier. These reserves have been heavily drawn upon in connection with requirements in the United States, for about halfway through the year a serious shortage of Straits tin developed, and the premium for this brand increased to about £20 per ton, as a result of which users turned over to English refined. So serious did the statistical position become that it was obvious some steps must be taken to increase output in the New Year, and accordingly at the end of October the decision was reached to expand production as from January 1 this year to 40 per cent. of capacity. This step is undoubtedly a wise one, for producers were growing restive under the curb of a rate of curtailment which was obviously out of proportion to the volume of demand and the ruling price. Moreover, stocks in the hands of the tin pool are supposed to be nearly exhausted and there is little help to be expected from that quarter.

Although the tin position appears to be reasonably good, there is undoubtedly a danger that the present high level of price will encourage outside production and bring about in due course a deterioration of the statistical position, and not improbably the break-up of the producers' association. Trade is improving all the way round, but consumption of tin is not yet at a rate to justify the present price, and to that extent the level that has been reached by artificial manipulation may take a good deal of holding. Nevertheless, at the opening of another year there seems little fear of any major setback in the price of tin, for the scheme of restriction has the support of the governments concerned and may be said to be the most watertight arrangement seen for many a long day.

Lead a Dull Market.

Lead has been rather a dull and uninteresting market in 1933, the extreme variation in the quotation not amounting to more than £3. On January 3 last year, the opening market day, the quotation stood at £10 13s. 9d. for spot and £11 forward, and little change was seen until March, when values had advanced to £11 5s. and £11 7s. 6d. A definite turn for the better was seen with the inflationary movement in America, which took the price up to £12 1s. 3d. to £12 8s. 9d. early in May, and further to

£13 13s. 9d. by the end of the month. The top level was reached early in July at £13 16s. 3d. for spot and £14 1s. 3d. for forward, but a sharp reaction followed and by the end of that month values were £1 lower. With the seasonal slackening in demand, further ground was lost in August, and after being down to £11 for spot in mid November the year finished with the quotation below £12.

A feature of lead last year was undoubtedly the excellent manner in which demand in this country was maintained, but in contrast the Continent took less than usual, at any rate, during the earlier months, and Germany's usage has continued well below normal all the time. The cable trade has been distinctly disappointing, but the battery makers have been busy and a good demand has existed from the manufacturers of white lead. Without any hard and fast arrangement for curtailing production, output has been kept down to a reasonable level and stocks are not excessive, although in this country foreign lead in bonded warehouse has increased to a noticeable extent. On the whole, the duty has operated smoothly and consumers have been able to cover their requirements without undue premium over the London market, which has been maintained throughout the year at well below the parity of New York.

Spelter Disappointing.

Spelter opened last year quite well at £14 18s. 9d. for spot, with a contango of 3s. 9d., but by the end of January was down to £13 11s. 3d., recovering again during March and April to about £15 10s. In common with the other members of the non-ferrous group, a big advance was scored during June and July, the peak being reached on July 10 at £18 11s. 3d., but this level proved to be quite untenable, and by the end of the month the quotation was back to £17 2s. 6d. Still lower values followed, and late in September £16 12s. 6d. was quoted, while a couple of months later the price was fully £2 down, but before the year ended a recovery took place to about £15.

It must be confessed that during last year spelter was a very disappointing market, but the fault has really been with the Zinc Cartel in their decision to raise the rate of production from 45 to 50 per cent. of capacity during the course of the year. This action, coinciding as it did with a setback to demand, brought about a deterioration in the statistical position, and the technical position of the market weakened accordingly. Towards the end of the year sentiment improved somewhat on the news that the Cartel would be carried on for at least the first six months of 1934, but the general temper of consumers is to play a waiting game until they see how the stock position will develop. Latterly demand from the galvanising trade has been distinctly poor, the welcome improvement earlier in the year not being maintained. On the whole, the brassmakers have bought fairly freely, and the tonnage of high-grade zinc passing into consumption has been satisfactory, so that stocks of this quality in the country are now down to rather a low level. Latterly, a certain amount of friction has arisen between the Empire producers and users of G.O.B. brands over the question of the premiums demanded by Canada and Australia, but it is hoped that this dispute will be amicably settled in the near future.

The Foundry Industry Month by Month.

January.

MR. F. J. BALLARD is awarded O.B.E. Mr. Cornelius Chambers, of Gaskell & Chambers, brassfounders, receives Knighthood. Lieut.-General Sir George MacDonough succeeds Sir George Beharrel as President of the Federation of British Industries.

DR. ECKERT wins International Aluminium Competition prize. Mr. Frank Baxter is elected chairman of the Management Committee of the London Iron and Steel Exchange.

INSTITUTE OF BRITISH FOUNDRYMEN elects 44 new members.

February.

MR. E. V. RONCERAY is created Officer of the Legion of Honour.

NUMBER OF balanced-blast cupolas in operation now reported as 27.

FOUNDRY INSTITUTE of the Aachen Technical Academy holds symposium on foundry technology.

MR. K. HEADLAM-MORLEY is appointed secretary of the Iron and Steel Institute.

DR. W. H. HATFIELD is awarded the Bessemer Medal.

BRITISH INDUSTRIES FAIR has special exhibit of oil-fired furnaces.

MR. JAMES HENDERSON is elected President of the National Federation of Iron and Steel Manufacturers, in succession to Mr. E. J. George.

March.

SIR S. GEORGE HIGGINS is elected President of the Institute of Marine Engineers.

MR. H. F. COGGAN is elected a member of the Halifax Town Council.

MR. H. W. WINTERTON is elected President of the Refractories Association.

April.

FOUNDRY EXHIBITION opens, and for the first time in history Institute of British Foundrymen organise technical exhibit. Both are outstanding successes.

MR. FRANK J. LANAHAN is elected President of the American Foundrymen's Association.

MR. W. E. CLEMENT is elected President of Welsh Engineers' and Founders' Association, in succession to the late Mr. Fred J. Taylor.

MR. M. H. MAGDELENAT is elected President of the Association Technique de Fonderie.

May.

MR. H. E. COOKSON is elected President of the Staffordshire Iron and Steel Institute.

IRON AND STEEL INDUSTRIAL RESEARCH COUNCIL issues First Steel Castings Report.

THE JAMES WATT MEMORIAL INSTITUTE (BIRMINGHAM) is opened by Mr. Alan E. L. Chorlton, M.P., President of the Institute of Mechanical Engineers.

MR. A. E. ATKINS is elected President of the Institute of Welding Engineers.

FOUNDRY TRADE JOURNAL appointed official organ for the National Ironfounding Employers' Federation.

MR. ALBERT PORTEVIN delivers May Lecture to the Institute of Metals.

MR. C. ROWLEY, of the British Cast Iron Research Association, is awarded a Carnegie Scholarship.

MR. W. R. LYSAGHT, J.P., C.B.E., is elected President of the Iron and Steel Institute.

INSTITUTE OF BRITISH FOUNDRYMEN elects 52 new members.

MR. R. H. BRACKENBURY is elected President of the Foundry Trades Equipment and Supplies Association, in succession to Mr. D. H. Wood.

June.

THE ANNUAL CONVENTION of the American Foundrymen's Association is held in Chicago, and about 40 Papers are presented.

THE GERMAN FOUNDRYMEN'S TECHNICAL ASSOCIATION meets in Berlin and 16 technical Papers are presented.

DR. G. H. CLAMER is awarded the Seaman Medal of the American Foundrymen's Association.

THIRTIETH ANNUAL CONFERENCE of Institute of British Foundrymen is held in Cardiff under the presidency of Mr. C. E. Williams.

CIVIC AND UNIVERSITY WELCOMES are accorded. Mr. Roy Stubbs and Mr. J. E. Hurst are elected Vice-Presidents.

MR. J. W. GARDOM is awarded the Oliver Stubbs Medal.

OVERSEAS GUESTS included Mr. A. H. Moore (South Africa), Mr. Oliver Smalley (Pittsburgh), Dr. Guido Vanzetti (Italy) and Dr. C. W. Pfannenschmidt (Germany). Eight Papers were read and discussed.

July.

FOUNDRY EXECUTIVES on holiday. Trade steadily improving!

August.

THIS MONTH sees the following elected as Branch-Presidents of the sections of the Institute of British Foundrymen:—Mr. E. J. Lewis (Birmingham), Mr. P. A. Russell (East Midlands), Mr. J. Stone (Lincoln), Mr. A. Phillips (Lancashire), Mr. J. Taylor (Burnley), Mr. W. West (Preston), Mr. C. H. Kain (London), Mr. J. E. Mercer (Middlesbrough), Mr. J. D. Carmichael, O.B.E. (Newcastle), Mr. J. Currie (Scottish), Mr. T. Shanks (Falkirk), Mr. W. T. Kitching (Sheffield), Mr. W. E. Clement (Wales and Monmouth), and Mr. R. D. Welford (West of Yorkshire).

MR. AUGUSTE LE THOMAS, Director, French Cast Iron Research Association, is made Officer, Legion of Honour.

September.

MR. R. G. RUSSELL is the first Dominion foundry owner to present a Paper before the Institute of British Foundrymen. He described a one-man mechanised foundry.

SIR ROBERT HADFIELD, BART., F.R.S., D.Sc., presents £5,000 to Sheffield University, Metallurgical Department.

ANNUAL MEETING of the Iron and Steel Institute in Sheffield.

ANNUAL MEETING of the Institute of Metals in Birmingham celebrates Silver Jubilee.

INTERNATIONAL FOUNDRY CONGRESS held in Prague, under presidency of Prof. Pisek. British delegation, headed by Mr. John Cameron and Mr. V. C. Faulkner, is the largest. Twenty-seven Papers are presented. President Masaryck receives delegation, headed by Mr. Maas Geesteranus, President, Foundrymen's International Technical Committee. Prof. Pisek is elected President of International Committee and Mr. K. Gierdziejewski, of Poland, Vice-President. Committee accepts invitation to participate in convention to be held in America next autumn.

MR. HERRY AND MR. METTANER win French Cast Iron Research Society Prize for essay on use of cast iron as roofing tiles.

October.

THE BRITISH CAST RESEARCH ASSOCIATION inaugurate study course at headquarters. Real success is achieved and arrangements started for making it an annual feature.

INSTITUTE OF BRITISH FOUNDRYMEN elects 33 new members.

November.

AT ANNUAL MEETING of British Cast Iron Research Association, Major F. A. Freeth, O.B.E., D.Sc., F.R.S., is elected President, in succession to Sir Harold Hartley, C.B.E., M.C., F.R.S.

MAJOR VIVIAN, B.Sc., receives Telford Premium for his work on the testing of cast iron.

COMPLIMENTARY DINNER, presided over by Mr. P. B. Henshaw, is given to Dr. Fred Ibbotson on his retirement from the staff of the Metallurgical Department of Sheffield University. Mr. Harry Brearley makes presentation.

December.

BRITISH IRONFOUNDERS' ASSOCIATION hold banquet in London under the chairmanship of Mr. W. R. Blair, to celebrate, after months of negotiations, complete co-operation with their customers.

MR. K. S. MURRAY, chairman of the British Oxygen Company, is subject of mammoth testimonial on retirement for active service.

VISCOUNT LYMINGTON, M.P., is principal guest at London Foundrymen's Dinner.

PROF. HENRY LOUIS celebrates 78th birthday.

The Austrian Foundry Trade.

By Ing. STEFAN LEEB (Consulting Engineer).

THE Austrian foundry trade continues to suffer under the depressing commercial difficulties which have persisted since the Peace Treaties dislocated the vast economic field formerly afforded by the Austro-Hungarian Monarchy. It has also still to contend with the much too limited protection granted against foreign competition, and this competition is very actively engaged in securing a firm foothold in the Austrian market; it is striving by every means, inclusive of financial sacrifices, to attain that end. In this connection the foundries of Czecho-Slovakia may be particularly referred to. For a long time past these have been accustomed to find in Vienna an outlet for their castings; they are continuing their endeavours to keep that market, and the Austrian foundries have no light task in standing their ground against goods produced under notably more favourable conditions in the Czecho-Slovakian works, and in inducing Austrian engineering firms, together with other classes of consumers, to purchase Austrian home-made products.

The difficulties which surround the export of Austrian machinery and castings to the seceded States and to markets which formerly stood open to the Austrian engineering industry have had as a result a very great falling-off in the manufacture of castings, and hence in a quite notable decrease in the number of foundries in operation. Whilst before the war and even during the first years following it, taking the Austrian realm as it stands to-day with its six million inhabitants, there were about 10 steel foundries and approximately 140 iron foundries, the number to-day has fallen to a total of about 70, which, so far, have not had to close down and which continue working. But their working time is generally 24 to 30 hours only per week.

The efforts of the Austrian foundries by varying their programmes of production to meet another decline in the demand for castings, a decline due to the development of welding operations, and to the improvement and modification of other technical methods of working, have not invariably met with the success which investors and technical experts expected, and might reasonably have expected by reason of the economic situation. The catastrophic worsening of the foundry trade could not be foreseen by anybody, not even by the leaders of the Austrian Association of Iron and Steel Foundries.

Increase in Malleable Production.

A remarkable fact is that notwithstanding the limited demand for castings, there is a noticeable tendency towards the use of malleable castings, and firms which formerly only manufactured grey-iron or steel castings have since inserted in their programme the making of malleable-iron castings. Thus, the largest Austrian foundry, namely, the Waagner-Biro A.-G., of Vienna-Stadlau, has recently added the production of malleable iron, fittings mostly, to the manufacture of cast-iron face pipes, and has been able markedly to increase the profits of its foundry. The firm also owns an electric steel and a non-ferrous metal foundry.

Further, the manufacture of articles which formerly were not made in the Austrian foundries—such as baths, hydrants or water posts, and enamelware of various kinds—has now been taken in hand. The foundry of the "Landmaschinen Fabrik Hofherr-Ichrantz-Clayton-Shuttleworth A.-G.," in Vienna-Floridsdorf, one of the best equipped foundries of the country, now makes cast-iron baths which formerly were imported from Czecho-Slovakia and from Germany. For the present this manufacture is by hand-moulding with the provision of a sandslinger.

The Association of Austrian Foundries, under the direction of its President, Engineer J. E. Vogelsinger, by exerting influence upon the Government of the country for the time being, has endeavoured to equalise the effects of the restrictive policy of neighbouring States, by a kind of protective tariff, and whilst efforts in this direction to aid the home foundry trade have not always met with the result hoped for, yet steps in the same direction with a view to furthering home production of castings are being continued by the Dollfuss Government now in power, an activity which is concomitant with the economic self-help of the firms themselves. An improvement is certainly noticeable in the Austrian foundry trade, and although the

ING. STEFAN LEEB.

"Russian business," together with the greater activity of the Austrian foundries in connection therewith, was not sufficiently lasting to bring about improved market conditions—and these for a time were really deplorable—still the present openings for Austrian foundry products are now more satisfactory than they were three months ago, thanks to the effect of general international conditions and to recent commercial treaties.

The Linz Foundries.

The extent to which the Austrian foundry trade has declined, in the provinces especially (Vienna, with its 2 million inhabitants, retains the financial and industrial preponderance over the nine Federated States), is illustrated by the Linz foundries, Linz being the chief town of Upper Austria. There were a few years ago in that city six foundries in operation, including one steel foundry. To-day, only two are working, and the steel foundry is shut down. There is in Vienna only one firm making electric-steel castings; the other four works manufacturing steel castings are located in the provinces of Styria and Lower Austria. The Burgenland province has not one single foundry and takes from Vienna and Lower Austria the castings required by the agricultural machinery and sugar works.

British Exports Suffer.

The only ironworks now in blast are those of the "Oesterreichische Alpine Montan Gesellschaft," which owns blast furnaces at Eisenerz and Donawitz (Styria), generally, there is only one blast furnace—two at the most—in blast; the firm also produces grey foundry pig-iron containing about 2.5 to 3.5 of silicon. Formerly, much English pig-iron was used in the Austrian foundries, especially that coming from the Clarence Iron Works. After the war, however, the imports fell to such a degree that they are now hardly worth mentioning; this great decline is certainly not attributable in any way to lack of quality, but entirely to cost. The Austrian founder has always greatly appreciated English pig-iron owing to the regularity of its analysis, low percentage of sulphur, high phosphorus, and partly also owing to the fluidity of the pig-iron in the liquid state.

As soon as financial conditions in Austria allow of lifting the present restrictions on foreign trade, together with the conditions limiting free commercial intercourse, it is quite probable that for the supply of raw material a renewal will take place of the satisfactory business connections with English ironworks.

But the "Alpine," as the firm is named in the trade, makes castings in its Zeltweg foundry (Styria) only to meet its own requirements; its main product, besides pig-iron, is rolled steel and semi-finished materials. For this manufacture it owns first-class iron-ore deposits at Erzberg, in Eisenerz (Styria), and in Hüttemberg (Carinthia), but no coke, which is imported from the Ruhr district in Germany, or from Czecho-Slovakia or Prussian Silesia. The open-hearth steel plant and the rolling-mill installation are quite modern and have been rationalised of late on the basis of present-day experience in regard to steel metallurgy. Home demands, however, do not at all suffice to keep such an undertaking, put down in entirely different circumstances, fully occupied for even part of the time. Owing to the check laid on exports by high tariff walls, the returns the works will be able to show for some time to come are a point which is causing great concern to the highly-qualified experts who form the Board of Management. The workmen are employed at most for two or three days in the week. The operatives at the present time—about 1,200 men—are only one-third the number which were normally employed by the Alpine in former years.

The Engineering Industry.

The engineering industry, which still has to be considered as the main customer of the foundries, has suffered for years from the check on exports to former markets, the Balkans and the Secessionist States and Territories. Considering, for example, the import duty of 8 ke. per kilo (about 8d. per lb.), which is charged on imports of ordinary machine types into Czecho-Slovakia, no engineering industry in the world can compete with that country's domestic industry. Better quality and greater efficiency cannot break down such tariff barriers; they make all exports absolutely impossible. Similar conditions prevail in all other Central European States; after the war, foundries and engineering works may be said to have been "planked down" anyhow, everywhere, but they lacked the most important requirement for satisfactory industrial production, namely, practical experience. Their output was what one would expect. The main consideration in the mind of Government Authorities was the establishment of a "national industry" to render the country independent of outside sources of supply, even when such outside sources were less than one and a-half hours' railway journey from the

new capital city. Attempts have been made, by engaging Austrian specialists, moulders and melters, to remedy the evil, which was found to be a real one in the view of the more enlightened industrialists of the new neighbouring States; but in foundry work very many conditions come into play which cannot be purely and simply transferred from one country to another; there is the quality of the moulding sand, the method of melting, the handling of a melt, experience as to the best and least costly moulding process for any given casting, and so forth.

This applies perhaps more especially to the manufacture of non-ferrous castings. In this connection, it may be remarked that, despite high tariffs, the cleanest castings still come from Vienna, when the chief consideration is not so much one of actual cost as one of good taste and pleasing appearance. German-silver fittings, bronze ornamental work, etc., still continue to be exported to some extent, notwithstanding the tariff ring which encircles the land. The Austrian non-ferrous metal foundries are, however, mainly small or medium-sized installations, of a series of large works which were well known in the time of the late monarchy—such as Metallwerk Stein, in Oed; Metallwerke Hainisch, in Nadelburg; Specialbronzen-und Metallwerke A.-G., in Wien XIII, etc.—is to be deplored, and constitutes a distressing result of a mistaken economic policy which, in the present age of flying machines and wireless, continues to display its activity in the small Central European countries, having six, eight or fourteen million inhabitants, where there was formerly one large State of 58 millions. Of all the follies committed during the last twenty years, this is certainly the greatest!

Aluminium Foundries.

The Austrian aluminium industry is limited to two works which make aluminium ingots; one is in Lend (Salsburg province) and the other in Steeg (Upper Austria). As a rule, the aluminium foundries constitute an annexe to other foundries. There are in operation only about ten foundries which deal with aluminium alone and manufacture pistons, household articles, etc.

ment of foundry teaching and also endeavours to impart the best possible training consistent with the rather low funds at his disposal. The installation of the school in question is worth seeing; it has been visited repeatedly with great interest by all who are concerned with technical education. The Austrian Association of Iron Foundries has founded at the Technological Trade Museum a semi-state institution for the instruction and creation of qualified master foundrymen; this deals with improvements in working methods and the solution of questions connected therewith. In this institution training is given in the conduct of melting operations, in the analyses of raw materials and finished products and so forth. By these means the Austrian foundry trade can always be regularly supplied with trained foundrymen and moulders, whilst the foremen actually in service are always able to gain further experience.

Young technical men who desire to enter the foundry trade are further afforded the opportunity of availing themselves of the facilities given by the State Institution for Engine Con-

Two Views of the Recently-Mechanised Foundry of the Midland Electric Manufacturing Company. It makes Switch and Fuse-Box Castings

not works in the real sense of the word; there are, nevertheless, a few larger plants which make yellow brass, bronze, gunmetal and also aluminium castings—their number does not exceed eight at the present time, and they include makers of semi-finished products, such as rods, rolled material, etc. The small and medium-sized installations number about 40 and produce as a rule clean and serviceable wares; in most cases these are so-called "clients' foundries"—in other words, they manufacture castings against an agreed payment for "foreign account."

In spite of the primitive lay-out (the coke-fired pit furnace taking graphite crucibles is still the one mostly used), the melting methods have been markedly improved of late years; now one scarcely ever comes across a non-ferrous metal foundry in which the new melting process, namely, the oxidising and reducing melting process, using carefully-prepared fluxes made up mostly of home-produced elements, is not resorted to. The first practical results with a metallic nickel deoxidiser and with a copper deoxidisation metal were first arrived at in Austrian foundries, these being Austrian discoveries. These copper and nickel specialities are made in Vienna and are supplied as far as Australia.

The retrogression caused by the serious commercial crisis of latter years has been much more detrimental to the heavy-metal industries than to the smaller ones, and the shutting down

The combined foundries, the most important of which is the firm of Franz Zimmermann, of Söhne, Vienna XVI—well known in the Austrian motor-car industry for the good quality of its castings—manufacture all classes of aluminium castings. They may also be said to be noted in connection with their melting technique. These aluminium foundries use for the most part a new gas-removal and close-grain-promoting process, which can be prescribed for all classes of aluminium alloys. The new process in question yields faultless castings of the highest density and degree of purity.

An Austrian research foundry is successfully dealing with the manufacture and testing of an incorrodible aluminium alloy; the results so far achieved give promise that this question, one of greatest importance to the aluminium working-up industry, will soon receive a satisfactory solution.

The Educational Activities.

The training of the rising generation is entrusted in Austria mainly to trade schools, the principal one of which is that in Vienna VI, 87, Mollardgasse, admirably equipped for the teaching of iron and non-ferrous foundry apprentices, and counting amongst its teaching staff of specialists a number of practical men employed in the Vienna foundries; the apprentices are thus taught both theory and practice. The man at the head of this school, Engineer J. Czoppy, attaches special weight to the development of foundry teaching and also endeavours to impart the best possible training consistent with the rather low funds at his disposal. The installation of the school in question is worth seeing; it has been visited repeatedly with great interest by all who are concerned with technical education. The Austrian Association of Iron Foundries has founded at the Technological Trade Museum a semi-state institution for the instruction and creation of qualified master foundrymen; this deals with improvements in working methods and the solution of questions connected therewith. In this institution training is given in the conduct of melting operations, in the analyses of raw materials and finished products and so forth. By these means the Austrian foundry trade can always be regularly supplied with trained foundrymen and moulders, whilst the foremen actually in service are always able to gain further experience.

Young technical men who desire to enter the foundry trade are further afforded the opportunity of availing themselves of the facilities given by the State Institution for Engine Construction and Electro-Technics, Erlachgasse 170, Vienna X, which also has at its disposal a well-equipped foundry for instructional purposes and has a special course for foundry teaching, conducted by State Councillor Prof. Ing. F. Murauer, an institution which is due in part to the initiative of the Austrian Section of the Verein deutscher Giessereifachleute.

German Foundrymen's Technical Association.

This body, which since its formation—in 1924—is under the capable direction of its President, Dr.-Ing. Friedrich Littner, the foundry manager of the largest Austrian foundry company, Waagner-Biro A.-G., Vienna, has as members all the heads of the Austrian foundries (directors, men in charge and foundry owners), also commercial men who are directly connected with the foundry trade. Its object is to serve both its members and the Austrian foundry trade by giving professional Papers and discussions on the problems surrounding foundry technique. It plays a prominent part in the life of the Austrian industry; its leading members are called upon by the State for collaboration when questions of political economy come up for consideration. The Austrian Institution of Foundry Specialists is the youngest member of the International Foundrymen's Association; as such, it will strive to pull its weight in the solution of the problems surrounding the technique of the foundry, problems which are of interest to the foundries the world over.

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The Foundry Pig-Iron Industry in 1933.

By BEN WALMSLEY, C.B.E. (Director, Dorman, Long & Co., Ltd.).

IT is a pleasant duty to record at last a turning point in the graph of pig-iron production in the United Kingdom. After the boom year of 1929, production fell steadily from 7,600,000 tons to the very low 1932 figure of 3,600,000, from which we have now risen in 1933 to an estimated figure of 4,100,000 tons. Fig. 1 shows, however, the distance yet to be travelled before the position can be regarded as satisfactory, but Fig. 2, which is virtually an enlargement in detail of the 1932/3 section of Fig. 1, shows

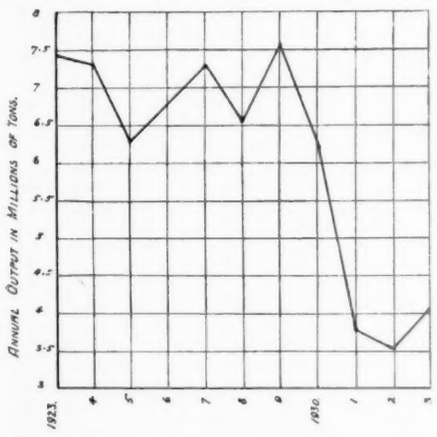


FIG. 1.—UNITED KINGDOM PRODUCTION OF PIG-IRON (ALL GRADES) FROM 1923 TO 1933 (1926 OMITTED OWING TO EFFECT OF GENERAL STRIKE).

that this improvement is no mere flash in the pan but that the corner has definitely been turned and steady progress made during the last eighteen months. Similarly the number of furnaces in blast has moved from 70 at the end of 1931 to 68 at the end of 1932 and 81 at the end of December, 1933, the latest available figure. Although these figures can hardly give grounds for enthusiasm, they are definitely encouraging, and even dissection of the figures into different grades does not mar the picture, since improvement is shown in all branches of the trade.

An investigation of the pig-iron import and export figures is a somewhat more doubtful tonic, for whereas imports have dropped in the last three years from 283,000 tons in 1931 to 140,000 tons in 1932 and now to 91,000 tons estimated in 1933, the corresponding returns of exports are 190,000 tons, 121,000 tons and 104,000 tons estimated in 1933. Comparison of these figures, however, shows that in 1931 imports were 115 per cent. of exports, in 1932 111 per cent. and last year only 87 per cent. These general statistics indicate the trend of events in the pig-iron trade during the past year without particular reference to foundry pig-iron, which, in conjunction with hematite, has formed rather more than 50 per cent. of the year's output. There has been, however, during the past year some important developments in the home trade as regards foundry iron, particularly in connection with the stabilisation of prices, and this aspect should be carefully reviewed.

During the year price alterations in England have been unimportant, but for delivery to Scotland prices of Middlesbrough, Northampton and Derbyshire qualities were, early in January, raised to a fair economic level owing to the culmination of negotiations among the producers. In 1932, largely due to the severe competition which was experienced from Continental and Indian makers, prices in Scotland were forced down to an absurdly low level, when certain descriptions of foundry iron were sold at less than 50s. per ton delivered to consumers.

By the beginning of January the virtual elimination of uncontrolled import enabled the Middlesbrough and Midland makers to advance their prices to the following levels:—

Middlesbrough No. 3, 57s. 3d. per ton;
Middlesbrough No. 4, 56s. 3d. per ton;
Northampton No. 3, 55s. per ton.

These included delivery f.o.t. in the Falkirk district and for the Glasgow area the usual 3s. per ton extra was charged.

The next change occurred in June, 1933, when a general advance of 2s. 6d. per ton was made in all brands and to both Scottish districts. The only other alteration which has been made for delivery to Scotland was an advance of 1s. per ton on Northamptonshire qualities which came into effect on July 14.

In the Midland area there has been no general advance since 1931, but in April last an adjustment was made in four zones involving increases of 1s. to 2s. 6d. per ton, which applied to all Derbyshire and Northamptonshire brands.

It is perhaps rather strange that the only price movement in Scotch foundry iron was in a downward direction. In February the official figure was reduced from 67s. 6d. to 65s. f.o.t. makers' works. This apparent anomaly was caused by the competition of Indian foundry, the price of which had been gradually strengthening as Continental imports were reduced, but still remained below the Scottish level.

The net result of the price movements which have taken place during 1933 is that ironfounders in all districts of England and Scotland are now on a fair basis in relation to each other, and the old grievance which consumers in the Midland and North-East Coast districts had against their Scottish competitors has been removed.

It is evident that there has been a considerable increase in the consumption of foundry pig-iron during the year under review. No statistics are available to enable an accurate comparison to be made with previous years, but makers' stocks of foundry and forge iron are fully 140,000 tons less than they were a year ago. There has probably been some reduction in stocks in consumers' hands, and when these factors are taken into account, together with the increase in the production of pig-iron, it is clear that we have had a very marked advance in the rate of consumption.

Makers' stocks, which in some cases were in 1932 becoming an embarrassment, have now been reduced to quite reasonable dimensions, and in certain cases they are practically exhausted.

In view of this depletion of stocks and the resulting scarcity of certain brands of foundry iron, it is not surprising that additional furnaces have been put into blast and that preparations are being made to augment still further the output of foundry iron. Unfortunately the scarcity of coke at the moment prevents any important increase in the pig-iron output, and this is likely to affect the situation until the spring or early summer. The severe weather conditions have given rise to an exceptional demand for small coke for use in domestic boilers, both here and on the Continent, and until this demand falls away or additional coke ovens can be brought into commission, the scarcity of coke is likely to continue.

Another interesting factor in the situation is the marked advance in prices of all kinds of iron and steel scrap. This perhaps has had more influence on the consumption of basic than of foundry iron, but there is no doubt that iron founders are to-day using a smaller percentage of scrap and consequently a larger percentage of pig-iron than they were a year ago.

This reference to scrap naturally leads to some comment on the change in foundry practice which has taken place during the last few years. To those who have been connected with the trade for more than a quarter of a century this change must appear to be very marked. In the old days foundry practice was very haphazard and pig-iron was bought almost entirely on fracture without any regard to chemical analysis. The application of more scientific methods has enabled iron founders to effect very considerable economies by the use of a larger proportion of scrap and of cheaper brands of pig-iron. While this improvement in practice has undoubtedly been of benefit to the iron founders, it has during a period of ample supplies of scrap tended to restrict the consumption of pig-iron and has also brought about a change in the proportions of particular brands of iron which were formerly considered to be indispensable for the production of certain classes of casting.

It would appear that both the pig-iron manufacturer and his customer the iron founder may look forward with confidence to the trade prospects of the current year. There is every indication that the general improvement which had already made itself felt during the closing months of 1933 will be maintained and probably still further developed. Up to the present time this improvement is no doubt mainly in the home trade, but in the absence of further economic or financial troubles in other parts of the world, it is safe to conclude that our export markets will in the near future recover from the depression which has overshadowed them during the last few years.

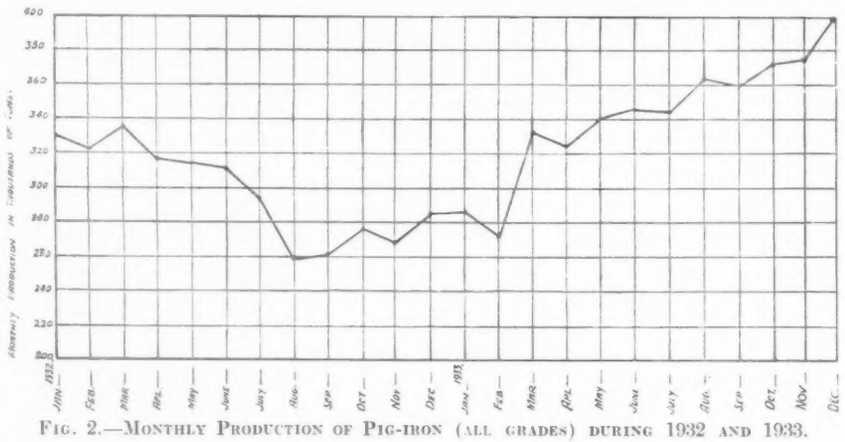
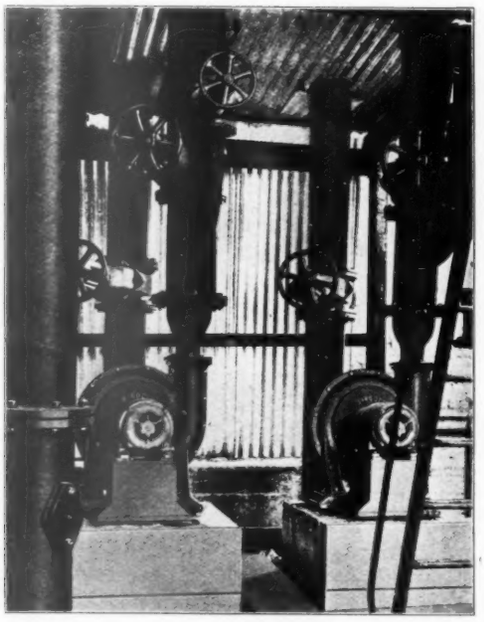


FIG. 2.—MONTHLY PRODUCTION OF PIG-IRON (ALL GRADES) DURING 1932 AND 1933.

A NEW TRADE SIROCCO MARK CATALOGUE!



No. S.F. 26 dealing with "Sirocco" Fan Manufactures for moderate and high pressures. It includes some interesting examples of recent installations and contains detailed and accurate information concerning duties, weights and dimensions for the wide range of sizes and designs listed. In addition, numerous tables assist in determining the most suitable "Sirocco" Fan Equipment for use under diverse operating conditions.

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The Nickel Industry in 1933.

MR. R. C. STANLEY (President, The International Nickel Company of Canada, Limited), reviewing the nickel industry in 1933, states that in the search for better products nickel in combination with iron and steel and with non-ferrous metals as well, has come to be a common denominator of the move towards alloys. Thus a metal which once was dependent on armaments for its market and which later won a great market in the post-war expansion of automobile production, now is enjoying increasingly diversified commercial applications throughout world industry.

World consumption of nickel in all forms for the first ten months of 1933 was 77,609,280 lbs., as compared with slightly more than 49,500,000 lbs. in the same period of 1932 and with the 112,481,600 lbs. of the corresponding part of the peak year, 1929. To some degree this increased consumption was due to prior liquidation of nickel-steel scrap, necessitating the use of new nickel in furnace operations; but an important reason for the improvement has been the increased industrial activity stimulated by the N.R.A. in the United States, which consumes more than half of Canada's production of nickel. Deliveries to countries other than America show correspondingly favourable increases over 1932. The number of foundries offering nickel cast-iron alloys in 1933 increased considerably, and the world consumption of nickel in cast iron was substantially greater than that for 1932.

Nickel Coinage.—Pure nickel for coinage is growing in popularity. According to the latest information, these coins have been minted for 27 countries in 72 issues representing 69 denominations. Approximately 3,000,000,000 pieces have been struck, the aggregate weight of which amounts to nearly 14,000 tons. The use of pure nickel for nickel-clad steel plate and nickel plating is also increasing.

With regard to non-ferrous nickel alloys, Monel metal (approximately 67 per cent. nickel) has during 1933 been applied to many additional services, and Inconel (approximately 80 per cent. nickel), introduced about two years ago primarily for dairy work, has also found important applications in other fields. The sales of nickel welding rods in 1933 increased by 50 per cent. over those of 1932. Nickel is being used increasingly as a colouring or decolouring agent.

Other uses of nickel in non-ferrous metallurgy include nickel brass and bronze, where up to 8 per cent. is used principally to refine the grain-size. Bearing metals containing up to a maximum of 2 per cent. of nickel are also absorbing larger quantities of nickel. Cupro-nickel alloys as used in oil refineries and which contain up to 50 per cent. of nickel are being used more extensively.

Nickel in Ferrous Alloys.

With regard to the application of nickel to ferrous alloys, a content of 12 per cent. is now fairly common in straight nickel steels.

Factors making for a better volume of nickel in the alloy steels, states Mr. Stanley, have been the slow but steady improvement of business in Europe, the recent progress towards industrial recovery in the United States, specifications for nickel-alloy steels in some of the largest projects under the American public works programme, the trend towards better materials in automotive construction and the practical stripping of the world market of nickel-steel scrap. In all producing countries the number of automobiles manufactured showed a definite increase, this being particularly true in Great Britain.

Specifications for the San Francisco Bay Bridge, now under construction, call for some 3,400 tons of 3 per cent. nickel steel to be used in both tension and compression members. When completed, this will be the world's longest bridge. At Boulder Dam 950 tons of 2 per cent. nickel-steel castings will be used.

A committee on materials, including a representative of the nickel industry, was recently appointed by the American Society of Agricultural Engineers. Two manufacturers of farm implements are already running tests on nickel-chromium steel for ploughs. There has been an increase in the tonnage of heat-resisting alloys produced in 1933 over that of 1932. This increase is due both to installation of new equipment and to replacement of inferior alloys.

In the low-temperature field, wrought nickel steels were selected for a large oil-refinery installation for dewaxing operations at temperatures from 50 deg. to 75 deg. Fah. below zero; and much of the auxiliary equipment includes both wrought and cast steels containing nickel. It was established experimentally in the Bayonne Research Laboratory that nickel within the range of ¼ per cent. to 1 per cent. is a powerful agent for conferring toughness at temperatures slightly below freezing point of the metal, particularly with steels containing more than 0.25 per cent. carbon.

The outstanding development during 1933 is the progress made in stainless-steel manufacture and the recognition of its structural qualities. First accepted by industry for its resistance to corrosion, it is now finding uses based on its inherent strength. Representative of the attention now being given this alloy because of its structural property is the development of aircraft frames and wing construction of stainless steel. So much smaller sections of this steel can be used without loss of strength, that the total weight is less than that of the larger sections required in the lighter alloys.

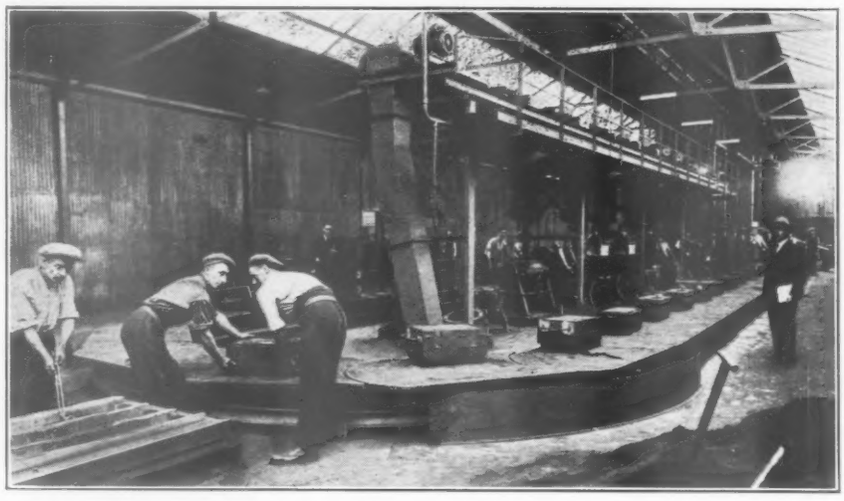
From the viewpoint of tonnage, the largest application of nickel during the year was in breweries, where its use in Canada and Europe for barrels, fermentation tanks and other equipment has led to similar use in the revival of the American brewing industry.

The consumption of nickel in cast iron in 1933 was between 55 per cent. and 60 per cent. above that for the previous year. The outstanding application developed during 1933 has been a nickel-chromium-molybdenum composition grain roll for hot rolling of metals. This particular composition possesses greater strength, more uniform structure, and greater wear resistance than compositions formerly used; it also resists the cracking tendency due to the high temperatures of service. Its success in this service has led to its use for other rolling-mill applications, such as mill guides, wire-bench guides, and expander and reeler plugs for drawing seamless tubing. In some of these cases the nickel cast iron has given approximately six times the service of the iron compositions previously used. Another important development of the year has been the extended production of nickel-chromium type of malleable cast iron. This material has a strength approximately 75 per cent. to 80 per cent. greater than that of regular malleable iron, and in addition has a higher degree of hardness, which ensures considerably better resistance to wear and abrasion. It has been adopted by the automobile and machine-tool industries; and, possessing a moderate degree of heat resistance, it is being used extensively for locomotive grate bars.

Ni-Resist.—First of the three special alloys to be developed, Ni-Resist was introduced to industry in 1930. In a report for 1932 it was cited as an important factor of survival for the cast-iron industry, which was suffering both from depression and from the growing inability of the traditional grey iron to keep up with the needs of modern industry. During the past year applications for this alloy continued to expand in the various fields requiring cast iron resistant to heat or corrosion.

Ni-Hard.—The year 1933 witnessed the establishment of chilled Ni-Hard rolls for both hot and cold rolling of sheet metals. For this purpose a modified composition was developed to permit machining of the necks, thus simplifying the manufacturing process.

Ni-Tensyliron.—The most recent of the three special nickel-alloy cast irons to be developed, Ni-Tensyliron, was introduced to industry late in 1932. Possessing greater strength and toughness, it is being used by foundries to provide products which can successfully compete with other materials to which simple cast iron had been losing business. A manufacturing advantage is that this alloy can be efficiently produced from a regular malleable-iron base mixture. Perhaps the most interesting application of Ni-Tensyliron during the past year was by a public utility company in an American city, which faced the problem of frequent breakage of manhole covers in the streets by heavy traffic. Replacement of the old covers with ones of this nickel composition has solved the problem. However, the most important uses for this type of iron are at present in machine-tool frames and parts, crusher frames, printing and paper machinery, dies and engine bases and frames.—"American Metal Market."



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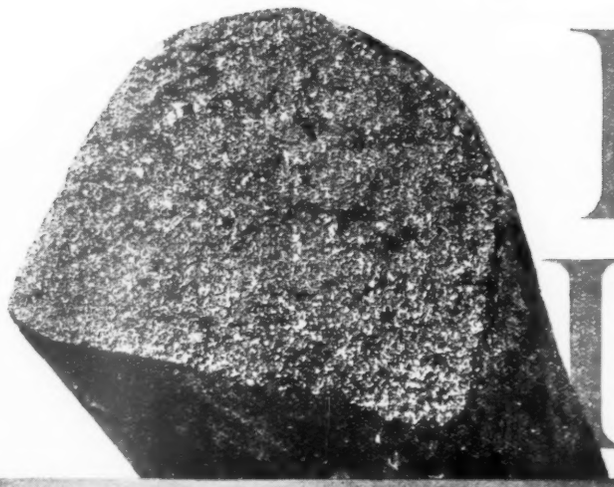

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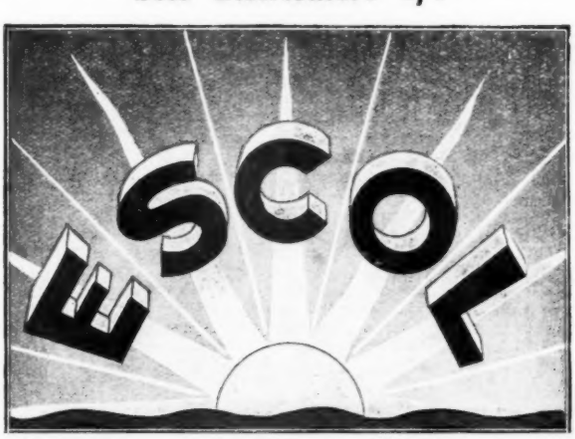

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This Week's News in Brief.

Trade Talk.

THE RENISHAW IRON COMPANY, LIMITED, Derbyshire, are relighting a blast furnace.

BRITISH INSULATED CABLES, LIMITED, Prescot, has received a £60,000 order from the Madras Government, India.

IN FUTURE the Horseley Bridge & Engineering Company, Limited, will be known as Horseley Bridge & Thomas Piggott, Limited.

MESSRS. GREENWOOD & BATLEY, LIMITED, Leeds, have appointed Mr. W. H. Tyce, 1, Kymin Terrace, Penarth, as their technical representative in South Wales.

MESSRS. R. & W. HAWTHORN LESLIE & COMPANY, LIMITED, Newcastle-upon-Tyne, have secured a contract for four steam locomotives and one electric locomotive for Messrs. Stewarts and Lloyds, Limited.

THE INDUSTRIAL SITUATION in Motherwell is brighter than for many years. The bridge-building works are busy on several large orders, and Messrs. Colvilles have nine furnaces in action at the Dalzell Steel Works for the first time for many years.

THE EMPLOYEES of the following firms in Scotland subscribed to infirmaries and kindred institutions last year:—The Larbert Foundry of Messrs. Dobbie, Forbes & Company, £133; Messrs. Bairds & Dalmellington, Limited, Glasgow, £6,717; Cameron & Roberton, Limited, South Bank Ironworks, Kirkintilloch, £218.

MESSRS. STEWARTS AND LLOYDS, LIMITED, Clydesdale Steel Works, Mossend, are gradually finding employment for their ex-employees at Corby, Northampton. Another batch of men left Scotland on Thursday last, and will be employed at Corby as assistants in the electrical department until their own particular work is ready for them.

MESSRS. WILLIAM BAIRD & COMPANY, LIMITED, Gartsherrie Iron Works, Coatbridge, are preparing for the rekindling of one, and probably two, additional blast furnaces. Messrs. Baird are also heating up an additional bank of coke ovens at Dumbreck by-products works, Kilsyth, which will bring the full complement of banks into operation.

THE MOTHERWELL BRIDGE & ENGINEERING COMPANY, LIMITED, have secured a welcome addition to their order-books, due to the acceptance of their tender for the Union of South Africa Public Works Department of a large tonnage of bridgework for the Orange River Bridge, 1,050 ft. in length, and the Umlass River Bridge, 410 ft. long. The steelwork involved is about 1,500 tons.

THE ANNUAL DINNER AND DANCE of the West of Scotland Iron and Steel Institute will be held in the Central Hotel, Glasgow, on January 29. Dr. Andrew McCance, of Colvilles, Limited, President of the Institute, will preside. The principal speakers will include Sir Robert Horne, M.P., Sir Arthur Huddleston, Principal of the Royal Technical College, Glasgow, and Mr. Edwin H. Lewis.

THREE CLYDE FIRMS have secured a portion of the contract for six oil tankers, each of about 11,000 tons carrying capacity, which has been placed by the Eagle Oil & Shipping Company, Limited, London. Messrs. Lithgows, Limited, Port Glasgow, Messrs. Blythswood Shipbuilding Company, Limited, Scotstoun, Glasgow, and Messrs. Harland & Wolff, Limited, Govan, Glasgow, have one boat each. The engines and machinery for the boat built by Messrs. Harland & Wolff will be constructed at the firm's Finnieston works, whilst Messrs. John G. Kincaid & Company, Limited, will construct the machinery for the other two vessels.

NEW APPOINTMENTS have been made at the Brymbo Steelworks, Wrexham, which will shortly be in full operation again. They are:—Manager, Mr. Glyn M. Jones; process manager and metallurgist, Mr. Thomas Roberts; chief engineer, Mr. T. G. Littleboy; chief assistant engineer, Mr. J. L. Daniel. The secretary of the company is Mr. W. L. Venables. Brymbo Steelworks, which were closed down in 1931, were acquired two or three months ago by a new company, of which Sir Henry Robertson is chairman of directors. About 50 men are at present engaged in repairing and reconditioning the works and plant, and it is hoped to have nearly all the former employees on the pay roll by April.

LITHUANIAN ORDERS for 15,000 tons of rails, which were to be placed in Italy, Belgium or France, are likely to be diverted to Lithuanian works, which, according to the inquiries of a Government commission, are in a position to produce these rails. It is also stated that tyres could be made at home instead of being imported as hitherto.

ACCORDING TO ESTIMATES of the Verein deutscher Eisen- und Stahlindustrieller (Association of German Iron and Steel Industrialists), the world output of pig-iron in 1933 totalled 48,400,000 metric tons, as against 39,800,000 and 55,800,000 tons in 1932 and 1931 respectively. German output was 5,234,000 tons, as compared with 3,933,000 tons in 1932, that of France 6,366,000 tons, against 5,537,000 tons; of Great Britain, 4,154,000 tons, against 3,630,000 tons; of Russia, 7,210,000 tons, against 6,217,000 tons, and of the United States, 13,690,000 tons, against 8,922,000 tons. World steel output at 67,800,000 tons was also higher than in 1931, when it reached only 51,000,000 tons. The largest steel producer in Europe was Germany, with 7,556,000 tons, as against 5,759,000 tons in 1932, while Great Britain was second with 7,305,000 tons, against 5,500,000 tons. Russia came third with 6,649,000 tons, against 5,900,000 tons in 1932, and France fourth with 6,594,000 tons, against 5,640,000 tons. The steel output of the United States advanced from 14,000,000 tons in 1932 to 24,164,000 tons last year, and that of Japan from 2,360,000 tons to 2,977,000 tons. Only in Great Britain and Russia were both the iron and steel outputs greater in 1933 than in 1931.

New Companies.

W. Wellens, Limited, Norah Street, Hollinwood, Oldham.—Capital £1,000. Brass and iron founders. Directors: W. Wellens and E. Chadderton.

Wm. Slater (Brassfounders), Limited.—Capital £1,000. Directors: W. Slater, 183, St. Mary's Road, Moston, Manchester; J. E. Mullett and E. Arundale.

Tiverton Foundry Company, Limited, Swan House, 133 and 135, Oxford Street, W.1.—Capital £1,000. Directors: A. H. Bint, H. G. Johnson, Mrs. F. H. Bint and Mrs. E. L. Johnson.

S. A. Edwards & Company (1933), Limited, Norwich Union Chambers, Congreve Street, Birmingham.—Capital £100. Dealers in iron, steel, ores and alloys, etc. Directors: J. F. Sjogren and G. A. C. Pettitt.

Sant Sturgess, Limited.—Capital £1,000. To take over the business carried on at 2, Alperton Viaduct, Ealing Road, Wembley, as "Knell & Sturgess," and to carry on the business of workers in stainless steel and metals, etc. Directors: R. S. Sturgess, Kate E. Sturgess and A. F. Bazlinton.

Ernest A. Webb, Limited.—Capital £10,000. To take over the business of iron and brass founders, constructional and electrical engineers, etc., carried on at Exning, Barton Mills, and Mildenhall, Suffolk, as "The Executors of the late Ernest A. Webb." Directors: Mrs. L. Webb, R. J. Webb and A. E. Webb.

Scrap-Metal Imports from U.S.A.

During the past month five steamers have been chartered to load a total of about 22,000 tons of scrap iron from the United States to this country, and negotiations for further shipments are proceeding. Prior to this movement there had been no imports of scrap from the U.S. for over two years. The sudden revival of this traffic is, of course, the reflection of the improvement in the iron and steel trades in this country and the consequent demand for scrap, which is used to an increasing degree as a raw material. But the immediate causes can be traced to other factors. Throughout the past year the principal sources of supply of scrap have been the shipbreakers' yards in this country—*e.g.*, Messrs. Thos. W. Ward, Limited, of Sheffield; The Hughes Bolckow Shipbreaking Company, Limited, of Blyth, and Metal Industries, Limited, of Glasgow. Recently, however, the possibility of a subsidy for British tramp shipping has tended to diminish the number of old laid-up ships offering for sale for breaking up, and the market has become more difficult from buyers' point of view. The following are the five steamers chartered, and the size and destination of their cargoes:—"Blairmore," 5,000 tons—Swansea; "Milos," 4,500 tons—Glasgow and Ardrossan; "Ottawa," 3,500 tons—Glasgow and Ardrossan; "Consul Cortitzen," 4,500-4,700 tons—Hull or Immingham, and "Virginia," 3,900-4,100 tons—United Kingdom port to be nominated.

Personal.

DR. GUIDO VANZETTI has been elected managing director of Fonderia Milanese di Acciaio Vanzetti, Milan.

MR. JOHN P. JARDINE, of Ashfield Place, Loanhead, has retired after 57 years' service with the Shotts Iron Company, Limited.

MR. G. L. KIRKPATRICK, general manager of Messrs. Bruce Peebles & Company, Limited, engineers, Edinburgh, has been appointed managing director of the company as from January 1.

LORD HERBERT SCOTT has been nominated to succeed Sir George Macdonogh as President of the Federation of British Industries for the coming year. Subject to confirmation, Lord Herbert Scott will take office early in April.

MR. T. R. WILLER, managing director of the Motherwell Bridge & Engineering Company, Limited, left on January 10 for a few weeks' business trip to Egypt, Syria, Palestine and Iraq, where the company have several contracts on hand at the present time.

MR. AND MRS. ANDREW WALLACE KIDDIE, of Rossie Street, Arbroath, have celebrated their golden wedding. Mr. Kiddie served his apprenticeship as a moulder in Lilybank Foundry, Dundee, where he remained nine years. For over 30 years Mr. Kiddie was employed by Messrs. Alex. Shanks & Son, Limited, Dens Iron Works, from which he retired four years ago.

Will.

BAINES, E. N., director of Messrs. William Ayrton & Company, Limited, Gorebrook Ironworks, Longsight, Manchester £28,221

Obituary.

MR. WILLIAM C. JONES died at his residence in Blair Terrace, Hurlford, Ayrshire, on January 5. Mr. Jones, who had been in the employment of Messrs. Andrew Strang & Company, Limited, Blair Foundry, Hurlford, for over 43 years, and at the time of his death was secretary to the company, had been unwell for about a week, but his death was somewhat unexpected.

MR. CHARLES BAKER, founder and until recently proprietor and editor of the "Newspaper World," who was sometimes referred to as the "father" of the newspaper profession, died on January 13 at the age of 83. Mr. Baker began his working life as an apprentice in a Yorkshire iron foundry. He was apprenticed in 1866 at the foundry of Pearson & Spurr, engineers, Birstall.

Patent Specifications Accepted.

The following list of Patent Specifications accepted has been taken from the "Illustrated Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The last numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

18,489. OUBRIDGE, W. A. Centrifugal metal-casting machines. 402,694.

29,402. LANGENOHL, M. Production of centrifugally-chill-cast tubes that are not hard. 401,875.

15,313. MORGAN CRUCIBLE COMPANY, LIMITED, and WALKER, J. Hollow furnace walls. 401,768.

10,858. SANDBERG, C. P., SANDBERG, O. F. A., and SANDBERG, N. P. P. Manufacture of alloy steel rails. 401,666.

4,205. BADGER, F., and BRITISH MAXIUM, LIMITED. Melting or refining of magnesium and magnesium alloys prior to casting. 401,672.

3,140. DAELEN, F., LOOS, W. [trading as GLYCO-METALL-WERKE DAELEN & LOOS (firm of)], and ARMBRUSTER, DR. M. Casting of metal on the inside of hollow objects, such as axle brasses, bearing bushes, and the like, and apparatus therefor. 401,533.

27,956. GENERAL ELECTRIC COMPANY, LIMITED. Process for coating articles with molybdenum. 402,916.

10,133. SCHEMMANN, W., and KOTTMANN, F. Scaling and fettling machines. 403,263.

19,157. VEREINIGTE STAHLWERKE AKT.-GES. Tuyere for shaft furnaces. 403,321.

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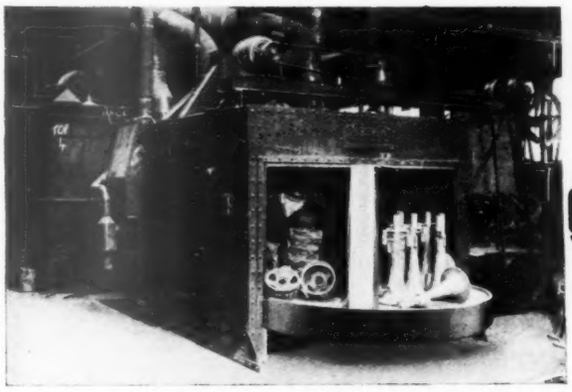
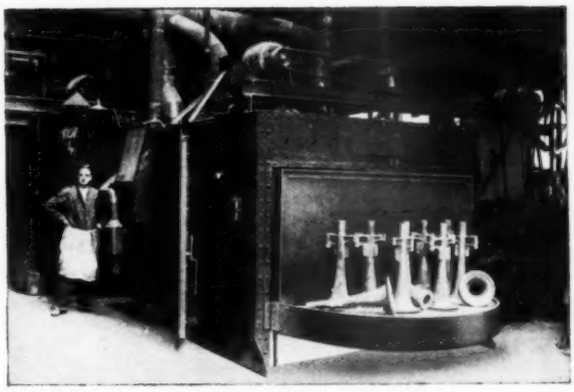
BROADHEATH, Near MANCHESTER
LONDON OFFICE—17, GROSVENOR GARDENS, S.W.1

THE ORIGINATORS OF THE SAND BLAST PROCESS

OUR PLANTS MEET THE REGULATIONS OF THE HOME OFFICE IN EVERY WAY



MAY WE QUOTE YOU?



Two Views of a Sand Blast Room with Revolving Table adapted to meet Customers' Requirements
This Type of Plant is capable of dealing with continuous production.
Photographs Reproduced by Courtesy of the AUSTIN MOTOR CO., LTD.

SAND BLAST ROOM PLANTS

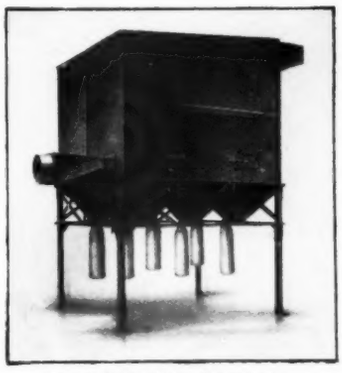
TUMBLING BARREL PLANTS

CHAMBER PLANTS

ROTARY TABLE PLANTS

ALSO
DUST ARRESTERS,
Etc.

PLACE YOUR PROBLEMS BEFORE US

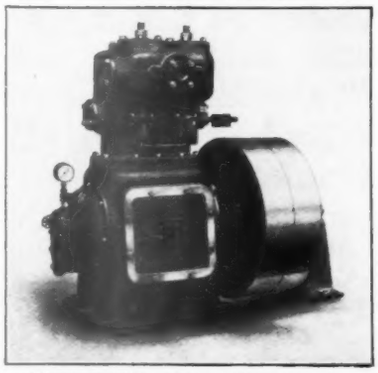


Dust Arresting Apparatus
Rigid Screen Type

TILGHMAN'S ARE PREPARED TO ASSIST IN ANY PROBLEM IN SAND BLASTING OR ITS POSSIBLE APPLICATION TO ANY OF YOUR MANUFACTURING PROCESSES

TYPE AND PRESSURES TO MEET YOUR REQUIREMENTS

—OUR EXPERIENCE IS UNRIVALLED—



Single Acting Compressors up to
200 Cubic Feet Capacity

15134 R.T.A.

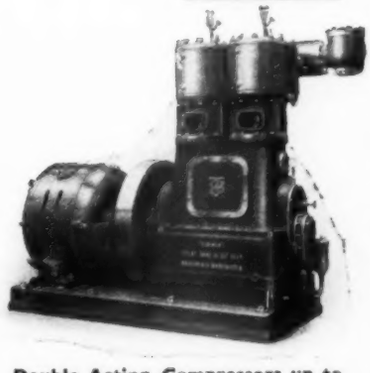
Also Makers of Air Compressors and Vacuum Pumps

Stationary Compressors, Single and Double Acting

Single Stage and Two Stage from 1 to 3,000 Cubic Feet Capacity per Minute.

Two Stage Portable Compressors from 60 to 300 Cubic Feet Capacity driven by Petrol or Diesel Engine or Electric Motor

—ENTIRELY— —BRITISH—



Double Acting Compressors up to
3,000 Cubic Feet Capacity

Raw Material Markets.

Generally speaking, the home demand for pig-iron is somewhat in excess of the current supply. An increase in prices is held to be imminent, and the producers are not desirous of entering into further forward contracts at the present quotations. An additional furnace is now in blast on foundry iron on the North-East Coast, and it is expected that further plant will be in operation shortly in that district, in the Midlands and in Scotland. The decreasing supply of scrap iron is also an important point in favour of the pig-iron market.

Pig-Iron.

MIDDLESBROUGH.—There continues to be a strong demand for pig-iron in this area, and it is just as well that an extra furnace has been blown in on Cleveland iron at the Skinningrove works. It is understood that an alteration in prices is to be made shortly. An increase has been expected for some time, in view of the increasing cost of coke. At the time of writing, however, no change has been made in the minima. For No. 3 Cleveland G.M.B. the official prices are 62s. 6d. delivered Middlesbrough, 64s. 6d. delivered North-East Coast, 62s. 3d. delivered Falkirk and 65s. 3d. delivered Glasgow.

The East Coast hematite market is very firm. Although the official quotations of 62s. 6d. for mixed numbers, f.o.t. makers' works, and 63s. for No. 1 quality, remain in force, it would be very difficult to buy iron at these figures. The makers are almost fully booked as regards their immediate output, and the merchants, convinced that a rise in the market is imminent, are asking a premium.

LANCASHIRE.—Little fresh business is being done in the Lancashire pig-iron market, largely because most of the bigger consumers have already covered themselves over the early months of the year. Slightly better conditions are reported in the consuming industries, and a hopeful view is taken of future prospects in this area. Prices remain unchanged, quotations for delivery in the Manchester area being on the basis of 67s. per ton for Derbyshire, Staffordshire and North-East Coast brands of No. 3, with Northants at 65s. 6d. and Scottish foundry at about 79s. 6d.

MIDLANDS.—There continues to be a good demand for foundry iron in this area, and the furnaces are stated to be sending out more iron than they are making, i.e., stocks are being further reduced. In Northamptonshire the ironworks' stocks are not large, but at some of the Derbyshire furnaces they are stated to be still considerable. There have been no changes in values of ordinary foundry iron. The minimum Association rates delivered to Birmingham and Black Country stations are 62s. 6d. for Northants and 66s. for Derbyshire, Lincolnshire and North Staffordshire No. 3.

SCOTLAND.—Activity at the Scottish foundries is slow to improve, except as regards those engaged in the light-castings trade. Scottish No. 3 foundry remains at 65s. f.o.t. furnaces, with 2s. 6d. extra for No. 1. There has been a certain amount of forward buying of this material. There is a constant demand for English irons, supplies of which are short. No. 3 Middlesbrough remains at 62s. 3d. f.o.t. Falkirk and 65s. 3d. f.o.t. Glasgow, other English irons being 1s. 3d. per ton less.

Coke.

The price of Durham foundry coke in the South Staffordshire area has now been advanced by 1s. per ton, a rise having been long anticipated. The quotations now vary from 35s. to 39s. 6d., according to grade, delivered Birmingham and Black Country stations. Other quotations, delivered in this area, are:—Welsh coke, 33s. to 40s.; Scottish low-ash coke, 39s. per ton.

Steel.

Active conditions rule in most departments of the steel market, and in some sections of the industry consumers are exercising pressure to obtain supplies. In the semi-finished steel department, busy conditions prevail. Only a small proportion of the business passing is going abroad, and many of the British works are producing at capacity. Consumers seem anxious to place forward contracts, and extended periods of delivery are required by practically all the manufacturers.

The orders for railway material and ships placed at the end of last year are now being reflected in good specifications for the steelworks; but business in general descriptions of steel is somewhat irregular, although the volume of trade appears to be growing. The demand, however, is largely from the home market and export business is handicapped by exchange difficulties. Some competition is met with in this branch from the Continental makers, whose prices, however, have recently been advanced. Nevertheless, the great bulk of the business in the home market continues to be placed with British works.

Scrap.

There is a broadening demand for scrap iron in the Cleveland area, where 51s. per ton is freely offered for ordinary heavy cast iron, 53s. for machinery quality, and 49s. for light metal. A regular demand continues to be experienced in the Midlands. Delivered in this area, quotations are 55s. for machinery scrap, 50s. for good heavy metal and 42s. 6d. for clean light cast iron. A slightly stronger demand for scrap iron is being experienced in Scotland, where machinery cast-iron scrap is at about 55s. and ordinary cast at 50s. to 51s. 3d. The demand remains quiet in South Wales, prices being unchanged.

Metals.

Copper.—Standard-metal quotations on the London market have shown irregularity, and it is evident that the demand from consumers is not yet at its normal level. Many consumers covered their needs for this month at the end of last year. The situation in the United States copper market remains unpromising, there being little demand at the moment and an exceedingly complex and uncertain outlook in the future. The proposed "code" for the American copper industry is still awaiting the final consideration of the Government, whilst the producers are still in possession of immense stocks of unwanted metal. Meanwhile, in other parts of the world, the production of copper is being steadily expanded at new mines whose working costs are far below those of the United States producers.

Messrs. Henry Gardner & Company, Limited, say "there is little doubt that the lull in consumers' business which has been in existence since Christmas, combined with the improvement in demand for manufactured copper and the reluctance of works to carry much stock over the turn of the year, may have brought about a situation in which a considerable tonnage will have to be covered in the near future."

The week's prices have been as follow:—

Cash.—Thursday, £32 to £32 2s. 6d.; Friday, £31 15s. to £31 16s. 3d.; Monday, £32 1s. 3d. to £32 2s. 6d.; Tuesday, £32 3s. 9d. to £32 6s. 3d.; Wednesday, £32 3s. 9d. to £32 5s.

Three Months.—Thursday, £32 2s. 6d. to £32 3s. 9d.; Friday, £31 17s. 6d. to £31 18s. 9d.; Monday, £32 3s. 9d. to £32 5s.; Tuesday, £32 6s. 3d. to £32 8s. 9d.; Wednesday, £32 6s. 3d. to £32 7s. 6d.

Tin.—The tin market has maintained a fairly steady tone, although there has been a lack of demand from consumers. To a certain extent, this is due to a seasonal falling-off in the demand for tinplates. A similar situation prevails in the United States, where the tinplate mills are reported to be working at about only 35 to 40 per cent. of their normal capacity. Strenuous efforts are being made by the American motor-car makers to keep up their recent high level of production. Discussion continues on the subject of the proposed "buffer" pool, which it is suggested should be established by the Tin Producers' Association with a view to preventing excessive fluctuations in market prices. The general comment seems to be that insufficient attention is being paid to the interests of the consumer.

Daily quotations:—

Cash.—Thursday, £226 15s. to £227; Friday, £227 to £227 5s.; Monday, £227 5s. to £227 10s.; Tuesday, £227 15s. to £227 17s. 6d.; Wednesday, £227 10s. to £227 12s. 6d.

Three Months.—Thursday, £227 5s. to £227 10s.; Friday, £227 7s. 6d. to £227 10s.; Monday, £227 12s. 6d. to £227 15s.; Tuesday, £228 2s. 6d. to £228 5s.; Wednesday, £227 12s. 6d. to £227 15s.

Spelter.—Dealing has been rather restricted on the London Metal Exchange, prices showing a fairly steady tendency. The trade demand has not been very large. The December statistics turned out to be rather worse than was expected. They revealed an increase in Cartel producers' stocks during the month of over 5,000 tons, partly accounted for by an increase in total output to the extent of about 2,000 tons.

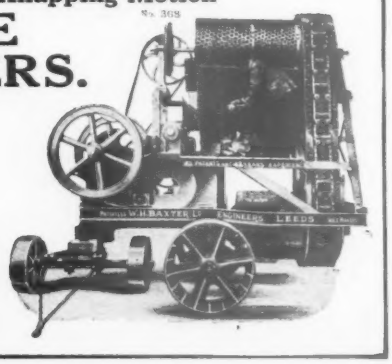
Price fluctuations:—

Ordinary.—Thursday, £14 13s. 9d.; Friday, £14 10s.; Monday, £14 12s. 6d.; Tuesday, £14 12s. 6d.; Wednesday, £14 15s.

Lead.—In their weekly report, Messrs. Brandeis, Goldschmidt & Company say that this metal has now reached a price which is so low that only a slight fall elicits support. Leaving aside the American situation, which is unsatisfactory owing to the tendency for stocks to accumulate, there can be no doubt that consumption generally is improving. This has been particularly noticeable in the pipe and sheet trades in this country, due to the revival of building activity.

Daily market prices:—

Soft Foreign (Prompt).—Thursday, £11 5s.; Friday, £11 1s. 3d.; Monday, £11 3s. 9d.; Tuesday, £11 6s. 3d.; Wednesday, £11 8s. 9d.

BAXTER'S
Patent Knapping Motion
STONE BREAKERS.
UNEQUALLED
Sole Makers:—
W.H.BAXTER, LTD.
LEEDS.


FERRO ALLOYS
ALL GRADES, IN POWDER, OR LUMPS FROM STOCK.
FOUNDRY SUPPLIES
FOR IRON OR STEEL.
REFRACTORIES, LADLES, ELECTRODES, ORES AND MINERALS.
WATSONS (Metallurgists) LTD.
Head Office:
ADELAIDE WORKS, MOWBRAY STREET, SHEFFIELD, 3.
Works: PLATT STREET, NEEPSEND, SHEFFIELD.

For perfect castings

you can rely on *Genuine* Cold Blast Pig Iron! It will not let you down. There is no surer way to better, sounder and more homogeneous castings.

Despite modern innovations in the form of so-called "refined cold blast" irons, synthetic irons, &c., our Brands of Cold Blast Pigirons still retain their place for superiority.

The principles of their manufacture remain the same as ever—slow-smelting, in small blast-furnaces, from specially selected ironstones, with low-pressure blast *at atmospheric temperature*, and low output (20/25 tons per day per furnace). No steel is added in any shape or form.

Being first-fusion irons, their inherent physical properties are not lost on remelting, but persist through to the castings produced therefrom.

The structure of our C.B. irons is naturally pearlitic. The graphite is remarkably finely divided and appears in thin lines rather than flakes.

AMONG THEIR CHIEF CHARACTERISTICS ARE: GREAT DENSITY AND HOMOGENEITY, GREAT STRENGTH & TOUGHNESS, REMARKABLE RESISTANCE TO SHOCKS, WEAR AND VIBRATION AND TO GROWTH UNDER HEAT; EASY MACHINABILITY, EXCELLENT CASTING PROPERTIES.

PUT A PERCENTAGE OF *GENUINE* C.B. IN YOUR MIXTURE AND REDUCE FOUNDRY LOSSES!

THE EARL OF DUDLEY'S ROUND OAK WORKS, LTD.,
BRIERLEY HILL, STAFFS.
Brand: "DUD·L.N.F'ces·DUD"

M. & W. GRAZEBROOK,
LIMITED,
DUDLEY, WORCS.
Brand: "GRAZEBROOK"

THE LOW MOOR IRON
CO., LTD.,
NEW WORKS, LOW MOOR,
BRADFORD - YORKSHIRE.
Brand: "LOWMOOR C.B."

MAKERS OF GENUINE COLD BLAST PIG IRON

XUM

RAW MATERIALS—PRICE LIST.

(Wednesday, January 17, 1934.)

COPPER.

	£	s.	d.
Standard cash	32	3	9
Three months	32	6	3
Electrolytic	35	5	0
Tough	34	0	0
Best selected	34	10	0
Sheets	62	0	0
India	43	10	0
Wire bars	35	10	0
Ingot bars	35	10	0
H.C. wire rods	38	7	6
Off. av. cash, December	31	6	11 13/19
Do., 3 mths., December	31	9	5 13/19
Do., Sttlmnt., December	31	6	11 13/19
Do., Electro, December	34	14	2 17/19
Do., B.S., December	34	1	11¼
Do., wire bars, December	35	1	10 2/19
Solid drawn tubes			10d.
Brazed tubes			10d.
Wire			6½d.

BRASS.

Solid drawn tubes	9d.
Brazed tubes	11d.
Rods, drawn	8¾d.
Rods, extd. or rlld.	4¼d.
Sheets to 10 w.g.	7½d.
Wire	7¾d.
Rolled metal	7d.
Yellow metal rods	4¼d.
Do. 4 × 4 Squares	5¾d.
Do. 4 × 3 Sheets	5¾d.

TIN.

	£	s.	d.
Standard cash	227	10	0
Three months	227	12	6
English	228	0	0
Bars	229	5	0
Straits	232	10	0
Australian (nom.)	—		
Eastern	230	5	0
Banca	232	5	0
Off. av. cash, December	227	14	10 8/19
Do., 3 mths., December	227	15	7 17/19
Do., Sttlmt., December	227	14	5 13/19

SPELTER.

	£	s.	d.
Ordinary	14	15	0
Remelted	14	5	0
Hard	12	0	0
Electro 99.9	16	17	6
English	15	7	6
India	13	15	0
Zinc dust	20	0	0
Zinc ashes	3	5	0
Off. aver., December	14	16	6 3/19
Aver. spot, December	14	18	10 7/38

LEAD.

	£	s.	d.
Soft foreign ppt.	11	8	9
Empire	11	11	3
English	12	15	0
Off. average, December	11	8	7 5/19
Average spot, December	11	10	10 3/38

ALUMINIUM.

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	24	10	0
Do., V.M. ex whse.	23	2	6
Rods	28	15	0

ANTIMONY.

	£	s.	d.
English	37 10 0 to 40	0	0
Chinese, ex-whse.	26	10	0
Crude	20	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	9	0	0 to 9 7 6

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£6 10 0
45/50%	£13 0 0
75%	£18 2 6
Ferro-vanadium—	
35 50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free of Mo.	5/6 per lb.
Ferro-titanium—	
23/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£14 10 0
Ferro-tungsten—	
80/85%	2/6 lb.
Tungsten metal powder—	
98/99%	2/9 lb.
Ferro-chrome—	
2/4% car.	£32 0 0
4/6% car.	£23 0 0
6/8% car.	£21 12 6
8/10% car.	£21 12 6
Ferro-chrome—	
Max. 2% car.	£34 10 0
Max. 1% car.	£35 12 6
Max. 0.70% car.	£37 10 0
70%, carbon-free	10½d. lb.
Nickel—99.5/100%	£225 to £230
"F" nickel shot	£202 10 0
Ferro-cobalt, 98/99%	5/- lb.
Metallic chromium—	
96/98%	2/8 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to £11 5 0
76/80% packed	£11 15 0 to £12 5 0
76/80% export	(nom.) £9 15 0
Metallic manganese—	
94/96% carbon-free	1/2 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to $\frac{1}{16}$ in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

South Wales—	£	s.	d.	£	s.	d.
Heavy steel	2	10	0 to	2	15	0
Bundled steel and shrngs.	2	2	6 to	2	12	6
Mixed iron and steel	2	6	0 to	2	9	0
Heavy cast iron	2	5	0 to	2	6	0
Good machinery	2	7	6 to	2	10	0
Cleveland—						
Heavy steel	2	12	6 to	2	15	0
Steel turnings				1	15	0
Cast-iron borings				1	5	0
Heavy forge				2	10	0
W.I. piling scrap				2	5	0
Cast-iron scrap	2	11	0 to	2	13	0
Midlands—						
Light cast-iron scrap				2	2	6
Heavy wrought iron				2	15	0
Steel turnings, f.o.r.	1	13	0 to	1	14	0
Scotland—						
Heavy steel	2	11	3 to	2	12	6
Ordinary cast iron	2	10	0 to	2	11	3
Engineers' turnings				2	0	0
Cast-iron borings				1	18	9
Wrought-iron piling				2	11	3
Heavy machinery				2	15	0

London—Merchants' buying prices, delivered yard.

	£	s.	d.
Copper (clean)	25	0	0
Brass	19	0	0
Lead (less usual draft)	10	0	0
Tea lead	7	10	0
Zinc	9	10	0
New aluminium cuttings	68	0	0
Braziery copper	23	0	0
Gunmetal	24	0	0
Hollow pewter	150	0	0
Shaped black pewter	106	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	65/-
Foundry No. 3	62/6
,, at Falkirk	62/3
,, at Glasgow	65/3
Foundry No. 4	61/6
Forge No. 4	61/6
Hematite No. 1, f.o.t.	63/-
Hematite M/Nos., f.o.t.	62/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	69/6
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	62/-
,, No. 3 fdry.	66/-
Northants forge	58/6
,, fdry. No. 3	62/6
,, fdry. No. 1	65/6
Derbyshire forge	62/-
,, fdry. No. 3	66/-
,, fdry. No. 1	69/-
Scotland—	
Foundry No. 1	67/6
,, No. 3	65/-
Hem. M/Nos. d/d	66/-
Sheffield (d/d district)—	
Derby forge	59/6
,, fdry. No. 3	63/6
Lincs forge	59/6
,, fdry. No. 3	63/6
E.C. hematite	76/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	67/-
Staffs fdry. No. 3	67/-
Northants fdry. No. 3	65/6
Cleveland fdry. No. 3	67/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	80/-
Clyde, No. 3	80/-
Monkland, No. 3	80/-
Summerlee, No. 3	80/-
Eglinton, No. 3	80/-
Gartsherrie, No. 3	80/-
Shotts, No. 3	80/-

FINISHED IRON AND STEEL.

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.)	9	0	0 to	9	15	0
Nut and bolt iron	6	17	6 to	7	10	0
Hoops	10	10	0 to	12	0	0
Marked bars (Staffs) f.o.t.		12	0		0	0
Gas strip	10	10	0 to	12	0	0
Bolts and nuts, ¾ in. × 4 in.	13	15	0			
Steel—						
Plates, ship, etc.	8	15	0 to	8	17	6
Boiler plts.	8	5	0 to	8	10	0
Chequer plts.				10	7	6
Angles				8	7	6
Tees				9	7	6
Joists				8	15	0
Rounds and squares, 3 in. to 5½ in.				9	7	6
Rounds under 3 in. to ¾ in. (Untested)	7	12	6 to	8	5	0
Flats—8 in. wide and over				8	12	6
,, under 8 in. and over 5 in.				8	17	6
Rails, heavy	8	5	0 to	8	10	0
Fishplates	12	0	0 to	12	10	0
Hoops (Staffs)	10	10	0 & up.			
Black sheets, 24g. (4-t. lots)			10	5	0	
Galv. cor. shts. (,,)			12	15	0	
Galv. flat shts. (,,)			13	5	0	
Galv. fencing wire, 8g. plain			14	0	0	
Billets, soft	5	10	0 to	5	15	0
Billets, hard	6	17	6 to	7	2	6
Sheet bars	5	0	0 to	5	10	0
Tin bars				5	0	0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	11d.
Sheet to 10 w.g.	12d.
Wire	11½d.
Rods	11d.
Tubes	15d.
Castings	13d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	19.26
No. 2 foundry, Valley	17.50
No. 2 foundry, Birm.	18.50
Basic, Valley	17.00
Bessemer	19.76
Malleable, Valley	17.50
Grey forge, Valley	17.50
Ferro-mang. 80%, seaboard	85.00
O.-h. rails, h'y, at mill	36.87½
Billets	26.00
Sheet bars	26.00
Wire rods	36.00
	Cents.
Iron bars, Phila.	1.89
Steel bars	1.75
Tank plates	1.79
Beams, etc.	1.70
Skelp, grooved steel	1.60
Steel hoops	1.85
Sheets, black, No. 24	2.25
Sheets, galv., No. 24	2.85
Wire nails	2.35
Plain wire	2.20
Barbed wire, galv.	2.85
Tinplates, 100-lb. box	$5.25

COKE (at ovens).

Welsh foundry	25/- to 27/6
,, furnace	17/6 to 18/6
Durham foundry	21/- to 25/-
,, furnace	16/6
Midlands, foundry	—
,, furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box		16/3
,,	28×20	,,	32/6
,,	20×10	,,	23/6 to 23/9
,,	18⅞×14	,,	16/10½ to 17/-
C.W.	20×14	,,	15/-
,,	28×20	,,	31/- to 31/3
,,	20×10	,,	21/9 to 22/-
,,	18⅞×14	,,	15/3 to 15/6

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6	0	0 to	£7	0	0
Bars-hammered, basis	£16	0	0 to	£16	10	0
Bars and nail-rods, rolled, basis	£15	15	0 to	£16	0	0
Blooms	£10	0	0 to	£12	0	0
Keg steel	£30	0	0 to	£31	0	0
Faggot steel	£18	0	0 to	£23	0	0
Bars and rods dead soft, st'l	£10	0	0 to	£12	0	0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.	
Jan. 11	..	32	0	0	inc. 15/–
„ 12	..	31	15	0	dec. 5/–
„ 15	..	32	1	3	inc. 6/3
„ 16	..	32	3	9	„ 2/6
„ 17	..	32	3	9	No change

Electrolytic Copper.

		£	s.	d.	
Jan. 11	..	35	0	0	inc. 5/–
„ 12	..	35	0	0	No change
„ 15	..	35	0	0	„ „
„ 16	..	35	5	0	inc. 5/–
„ 17	..	35	5	0	No change

Standard Tin (cash).

		£	s.	d.	
Jan. 11	..	226	15	0	inc. 47/6
„ 12	..	227	0	0	„ 5/–
„ 15	..	227	5	0	„ 5/–
„ 16	..	227	15	0	„ 10/–
„ 17	..	227	10	0	dec. 5/–

Tin (English ingots).

		£	s.	d.	
Jan. 11	..	227	10	0	inc. 55/–
„ 12	..	227	10	0	No change
„ 15	..	227	15	0	inc. 5/–
„ 16	..	228	5	0	„ 10/–
„ 17	..	228	0	0	dec. 5/–

Spelter (ordinary).

		£	s.	d.	
Jan. 11	..	14	13	9	inc. 7/6
„ 12	..	14	10	0	dec. 3/9
„ 15	..	14	12	6	inc. 2/6
„ 16	..	14	12	6	No change
„ 17	..	14	15	0	inc. 2/6

Spelter (Electro, 99.9 per cent.).

		£	s.	d.	
Jan. 11	..	17	0	0	inc. 10/–
„ 12	..	16	15	0	dec. 5/–
„ 15	..	16	17	6	inc. 2/6
„ 16	..	16	17	6	No change
„ 17	..	16	17	6	„ „

Zinc Sheets (English).

		£	s.	d.	
Jan. 11	..	24	10	0	No change
„ 12	..	24	10	0	„ „
„ 15	..	24	10	0	„ „
„ 16	..	24	10	0	„ „
„ 17	..	24	10	0	„ „

Lead (English).

		£	s.	d.	
Jan. 11	..	12	10	0	inc. 5/–
„ 12	..	12	10	0	No change
„ 15	..	12	10	0	„ „
„ 16	..	12	15	0	inc. 5/–
„ 17	..	12	15	0	No change

Imports and Exports of Iron and Steel Castings, etc., in December and the twelve months 1933, compared with December and the twelve months 1932

	December, 1932.	December, 1933.	Twelve months, 1932.	Twelve months, 1933.	December, 1932.	December, 1933.	Twelve months, 1932.	Twelve months, 1933.
Imports.	Tons.	Tons.	Tons.	Tons.	£	£	£	£
Pipes and Fittings, Cast	51	107	3,241	1,413	1,614	4,784	49,565	30,616
Castings, in the Rough, Iron	1	3	554	123	45	86	9,807	3,537
„ „ „ Steel	42	6	1,631	498	569	148	31,487	8,860
Hollow-ware, Cast, not Enamelled	3	2	47	50	217	189	2,827	2,901
„ „ Enamelled	12	4	251	114	559	329	8,150	6,065
Exports.								
BUILDERS' CASTINGS—								
To Argentine Republic	10	10	308	93	487	243	11,430	4,140
„ Irish Free State	292	447	3,526	4,033	12,006	20,983	155,492	173,450
„ British South Africa	98	245	1,507	2,502	3,589	9,198	53,583	96,923
„ „ India	84	140	892	1,107	2,836	5,183	33,982	39,274
„ New Zealand	40	21	347	283	2,604	1,370	18,861	16,193
Total (including other countries)	859	1,297	10,522	12,968	36,855	56,010	442,794	537,014
PIPES AND FITTINGS—CAST—								
To Argentine Republic	17	148	1,521	1,577	477	1,883	16,732	18,027
„ Irish Free State	302	927	6,111	7,436	4,616	11,437	84,331	97,765
„ British South Africa	442	298	4,385	8,564	4,621	4,448	50,622	80,999
„ „ India	87	90	1,101	1,412	1,970	1,374	18,307	21,928
„ „ Malaya	45	397	2,340	1,604	618	3,872	23,389	17,853
Total (including other countries)	5,186	8,040	65,539	86,327	55,144	82,529	670,494	834,153
HOLLOW-WARE—								
Cast, not Enamelled, and Cast, Tinned	252	301	2,555	3,552	8,715	11,066	88,769	112,702
„ Enamelled	50	51	790	720	3,833	3,798	65,326	57,098
CASTINGS, in the rough—								
Iron	108	350	1,114	1,344	3,615	4,477	38,379	38,737
Steel	53	102	724	1,032	3,285	3,606	32,095	40,256

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MAN offers services for position as Foundry Manager; sound practical knowledge of foundry work and experienced in the cheapest method of producing Rain-water, Soil and Drain Pipes, Ornamental and Crane Gutters and connections, also Ornamental Heads; experienced in working to architects' drawings and fixing moulders' prices from same.—Box 620, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

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Would you like to know more about him? How, in spite of his "One Exception," he is being educated and, when older, technically trained and usefully employed.
There is a long waiting list of "Peters" throughout the British Isles, for whom training and accommodation must be provided in the immediate future.
Will you help with a donation or annual subscription? Any sum, large or small, will be gratefully received.
Here's a suggestion. Your eyesight is worth 3d. a year to you. Send Peter and his handicapped pals 3d. for every year you've had it. Now, please, in case it slips your memory. Good idea?

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